

AN ANALYSIS OF QUESTION PAPERS OF PHYSICS
INTERMEDIATE EXAMINATION
1964 TO 1969

BOARD OF SECONDARY EDUCATION, MADHYA PRADESH
BHOPAL

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DISSERTATION FOR M.Ed. PART II EXAMINATION
OF
VIKRAM UNIVERSITY
1969

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Guide

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P R E F A C E

In order to make the educational system more effective a number of reforms are being introduced specially in the system of examinations conducted by various Boards. The reforms introduced need appraisal from time to time, so that their effectiveness continues to all who are involved in this gigantic task. The whole problem of " Examination Reform " has been tackled from various angles . The main criticism is against the question papers and the way in which the answers are assessed. With a view to improve the quality of question papers, many attempts have been made to analyse the various examination question papers and to suggest effective improvement in their pattern.

After the abolition of regular teaching for Intermediate Examination in recognised Schools and Colleges, the Board of Secondary Education Madhya Pradesh, Bhopal , started a correspondence courses to guide the students who wished to have the Intermediate Examination certificate. The courses of studies were not changed but new instructional material, new types of lessons and other new guiding lines were introduced by the correspondence courses to make this new endeavor more effective. With all these novelties the system of examination remained unchanged. The candidates were required to appear at the examination and to face the same traditional type of question papers. As a matter of fact there was a definite scope for improvement in the quality and type of question papers. Having observed this flaw in this new system of instruction, I decided to analyse the question papers of last five years in physics, set for the Intermediate Examination, and to study their trends which have been followed by the paper setters.

To deal with the task in hand on right lines there is always a need of experienced guide. I have no words to express my indebtedness to Shri S.N.Tripathi M.A.(History), M.A.(Psychology), B.Sc. M.Ed. who has very kindly guided me in my effort. He supervised my work with great interest, encouraged me and gave me very valuable suggestions to complete this study.

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Bhopal
10th April, 1969.

Rajendra Lal Singh
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CHAPTER I.

INTRODUCTION AND THE PROBLEM

Introduction :-

Education Commissions and Committees appointed by the Government of India have strongly felt the need of reforming examination in Indian education.

The University Education Commission, 1948, observed that, if they were to suggest one single reform in university education, it should be that of examinations.

The Secondary Education Commission, 1952 recommended a change in the status of internal examination and in the structure of external examination.

In 1956 the All India Council for Secondary Education organised a Seminar on examination at Bhopal for a threadbare analysis of the problems of reform of education and examination.

In 1957, The University Grants Commission appointed a Committee of experts to investigate and report on the reform of examination system in India Universities. In the same year, the Ministry of Education sponsored a series of 'Workshops' on Evaluation in Secondary Education and in the next year, the university grants Commission conducted a few Seminars on Evaluation in Higher Education.

In 1958, an Indian team of educationists visited the United States for the purpose of reviewing the methods and techniques employed in American Universities for the evaluation and measurement of education achievements.

In 1959, a team of American consultants evaluation and examination techniques visited India under an exchange programme to study the existing external examination system and observe its effects and stimulate further discussion of short-range and long-range possibilities for modification.

Also resolution of the eighth conference of the Chairmen and Secretaries of the Boards of Secondary Education in India, States"

As the knowledge of the concept and techniques of evaluation is a pre-requisite for effective teaching, it should find a place in the curriculum of Teachers Colleges. Some Universities have already modified their syllabuses by including necessary topics related to educational evaluation. Other Universities may also include them, so that the future teachers could be adequately equipped to shoulder the responsibility of implementing examination reform which is fast permeating the schools in the Country. The State evaluation units, Boards of Secondary Education and other concerned agencies may provide necessary help to the teachers colleges in expediting the implementation of the proposed changes".

All these expert bodies have recommended that each Board or University should setup an Examination Research unit to analyse the examination conducted under its supervision.

Generally, the Board of Secondary Education conducts public examination at the Secondary stage in a state. At this stage, the examination is mainly written. Most of the weaknesses in a written examination are due to defects in the questions and question papers set for the examination. Examination reform at the Secondary stage, therefore, mainly refers to the improvement of the questions and question papers.

Several Boards of Secondary Education in India have taken up the programme of examination reform in collaboration with the Department of curriculum and evaluation of the NCERT, New Delhi. These boards in collaboration with the Department of curriculum and evaluation sponsor a series of paper-setter's workshops which help to raise the technical competence of the paper-setters. Subsequently, the boards organize the training programmes for the teachers at the zonal level. In the teachers'

workshops, the teachers are acquainted with the basic principles on which examination reform is organized. They also teach the method of linking teaching with new evaluation technique so as to improve the teaching learning process in the classroom. On the conclusion of these programmes, the board direct the paper-setters to set questions on an improved line in the public examinations.

In practice, however, it has been found that a 'Vague' direction to the paper-setters to set an improved question paper does not serve the purpose well. A few nice questions may glitter here and there but on thorough scrutiny it will be found that the question paper as a whole is not an improved one. Moreover, a study of the essential features of a question paper from year to year would often show erratic variations what is necessary is that there should be a definite direction to the paper-setter about the nature of the question paper of the next year and the direction should have some scientific basis. It should be based on an analysis of the question paper of the previous year. The analysis should be made in respect of the objectives, content, form of questions, option, direction, and distribution of marks. If there are any special points, these may be mentioned under 'remarks' column. The analysis of student performance should be made in respect of some characteristics of item-scores distributions.

One of the first requisites of a good evaluation programme is to have a well defined set of educational objectives. Considerable work has been done in this regard for the stages of elementary and Secondary Education. The questions set in there examination are, by and large, so general that the length and scope of the answer often remain undefined. The content coverage of the written examination is extremely limited. There is hardly any element of thinking, application or

interpretation of knowledge involved in answering the question papers with the result that little demand is placed on the prospective teacher to develop sufficient insight and maturity in the theory and practice of education.

As teachers colleges have not so far introduced improved procedures of educational evaluation, they have not been able to set a good model to the teacher under training; or to schools in their neighbourhood. Nor have they been able to provide a lead in this direction to other faculties of their respective universities. The traditional examination procedures have also not helped teachers colleges to set a dynamism in their programmes by changing curricula and instructional procedures using the concept of evaluation as a guiding force, on the other hand, training colleges are perhaps in the most suitable position to improve their evaluation procedures. Not only that they possess a better technical know-how of improved evaluation procedures compared to that obtaining in our Secondary Schools at present, but also they have, in most cases, a manageable number of trainees per teacher. In many teachers colleges the teacher ratio is found some what between 1 to 10 and 15. This is almost an ideal situation to practice improved evaluation procedures.

Unfortunately, there is no active agency at present in the country to initiate, guide and carry out this project of evaluation reform at the stage of teacher education. Examination unit of the DPSE has already conducted a large number of evaluation workshops for training college lectures covering about 175 colleges, but its work is chiefly confined to the improvement of evaluation practices at the level of secondary education.

The New Concept of Evaluation. It is now agreed that evaluation is a continuous process, forms an integral part of the total system of education, and is intimately related to educational objectives. It exercises a great influence on the pupil's study habits and the teacher's methods of instruction and thus helps not only to measure educational achievement but also to improve it. The techniques of evaluation are means of collecting evidence about the student's development in desirable directions. These techniques should, therefore, be valid, reliable, objective and practicable. As the common method (and often the only method) of evaluation used at present in India is the written examination, a natural corollary of the acceptance of the new approach will be to improve the written examination in such a way that it becomes a valid and reliable measure of educational achievement. There are, however, several important aspects of the student's growth that cannot be measured by written examinations, and other methods such as observation techniques, oral tests and practical examinations, have to be devised for collecting evidence for the purpose. These methods need to be improved and made reliable instruments for assessing the student's performance and educational development.

Progress of the Movement for Reform. During the seven years of its existence the Central Examination Unit has made a multipronged attack for the popularization of the new concept and techniques of evaluation. It has worked with thousands of secondary school teachers in seminars and workshops, introduced hundreds of training college lecturers to the new techniques established a very large pool of test items, trained paper-setters attached to different Boards of Secondary Education, published a good deal of literature on evaluation and carried out or

sponsored several studies and investigations on various practical problems in examinations. As the work of the Unit expanded, the Government of India approved of the establishment of Evaluation Units in different States during the third plan period. So far, State Evaluation Units have started functioning in 12 States and one Union Territory.

But the task is a stupendous one, and it will take considerable time for the new measures to make their impact on objectives learning experiences and evaluation procedures in school education. The improvements already made in the external examination by the different Boards have not removed all its major defects. The objectives have not yet been enlarged to include the testing of application and problem-solving abilities. The character of the school examinations, at least in the senior classes, is determined largely by that of the external examination, and the new techniques of evaluation are not readily adopted in these internal examinations. Moreover all the efforts in the direction of reform have been confined to the field of secondary education. No attention has been paid to the improvement of examinations at the primary stage, and hardly any to the problems in this area at the university stage.

Evaluation at the Lower Primary Stage. One of the main purposes of evaluation at the primary stage is to help the pupils to improve their achievement in the basic skills and to develop the right habits and attitudes with reference to the objectives of primary education. These objectives and their implications for evaluation should be made clear to the teachers. As has been suggested in an earlier chapter, it would be desirable to treat the lower primary stage covering Classes I to IV as an ungraded unit, because this would help the children coming from different backgrounds to advance at their own pace. As the conditions in most primary schools, however are not favourable to the general adoption of this

procedure, we have recommended that the experiment should be tried out in the beginning in Classes I and II which should be regarded as a single ungraded unit. This will put an end to the existing practice of detentions in Class I and the drop-outs and wastage resulting therefrom, and will also provide for continuity and flexibility in the educational programme of the first two classes. The two-year block may be divided into two groups, one for slow-learners and the other for fast-learners to enable different pupils to proceed at the level of their ability and move from one unit to another. Such a division, however will be practicable only in a large-sized school with more than one section in each class. If the experiment regarding the ungraded unit succeeds in Classes I and II, it may be extended to the remaining classes of the Lower primary stage.

Teachers should be prepared for the ungraded system through the regular training courses and orientation programmes and should be helped with a supply of diagnostic tests and remedial material. The orientation may be given by the State Institutes of Education. Observation techniques, which are more reliable for assessing the pupil's growth at this stage than more formal techniques of evaluation should be used by teachers in a planned and systematic manner.

Evaluation at the Higher Primary Stage At present evaluation in these classes is carried out largely by means of written examinations. We believe that due importance should be given here also to oral tests which should form a part of the internal assessment. The teacher should be helped in such assessment with a rich supply of evaluation Organisations, including standardized achievement tests'. Diagnostic testing is necessary here and indeed through out the school stage. In most cases, such testing will be through simple teacher - made diagnostic tests. Cumulative record cards play a vital role in indicating the growth and

development of the pupil at each stage, his academic and emotional problems, and his difficulties of adjustment, if any and the directions in which remedial action is to be taken to solve his problems or difficulties. We are of the opinion that cumulative record cards intended for the primary classes should be very simple, so that primary teachers can use them with just a little training. In the first instance, the cards should be introduced from Class IV onwards in about 10 per cent of selected schools as an experimental measure; but once the majority of teachers are trained in evaluating certain important aspects of the child's personality and the proper maintenance of the records, the use of the cards may be gradually extended to all the higher primary and, as a next step, even to lower primary schools.

Is a Primary External Examination Necessary. An external examination at the end of the primary stage (Class VII or VIII) to be taken compulsorily by all pupils was strongly recommended by some witnesses who appeared before the Commission. We were informed that some of the States which had abolished the external examination at the end of this stage had either reintroduced it or proposed re-introducing it in the near future. It was pointed out that an external examination was necessary for (1) maintaining certain uniform standards at the end of the stage; (2) providing a basis for choice of courses at the secondary stage and (3) creating incentives for better teaching and learning. But all these arguments do not establish a case for an external examination of the formal type to be compulsorily taken by all the pupils in Class VII or VIII. Though we have recommended elsewhere that the first national standard of attainment should be defined at the end of the primary stage. We do not think it necessary or desirable to prescribe a rigidly uniform level of attainment for all the primary school pupils.

in a State or even in a district, through an external examination. Moreover, instead of creating incentives for better teaching, the external examination intended for all will saddle teachers with standardized programmes and encourage the process of rote memorization, which is the besetting evil of teaching and learning methods in our schools today. Again, since full-time education at the lower secondary stage will provide, by and large, general education without any streaming, the argument regarding the choice does not hold good ; and for the diversion of pupils to full-time stage, an examination which will merely test intellectual ability and academic attainment will not be of much help. We, therefore, recommend that no compulsory external examination should be held at the end of the primary school stage.

While we are not in favour of a compulsory external examination, we believe that for the proper maintenance of standards, periodic surveys of the level of achievement of primary schools is necessary. We recommend that such surveys should be conducted by the district educational authorities to assess the standard of performance of the schools in a given area by means of standardized or highly refined tests prepared by specialists in the State Evaluation Organizations. This procedure will enable the education officers to pick out the weaker schools and help them to improve their performance. It will also assist the schools in finding out the weakness of their pupils for purposes of remedial work.

A Common Internal Examination for Inter-school Comparability.

by making use of the standardized or refined test material referred to above, the district educational authorities may, if they so desire, arrange for a common examination to be taken by the pupils of all the schools in a district at the end of the primary stage. This common school leaving examination will be different from the school certificate examination now

Improvement of written examination - At present essay type questions are dominant, and they reduce content validity, reliability and objectivity of the tests. When options are provided things become still worse. To improve written examination we must improve questions, question papers and scoring procedures. The scope of written examination should also be widened to serve the purpose of educational diagnosis.

To eliminate the short comings of essay examinations, short answer and objective type questions may be introduced. This will enable a better coverage of course content than is possible with essay questions. This will also enhance the reliability and ease of scoring. We may retain some essay type of questions, but we must see that there is a clarity of language, specificity of instructions and well defined definiteness of the scope of answer.

Then the question paper, as a whole to be improved the weightage to different objectives must be in conformity with our national needs. The weightage to different topics and forms should be so arranged as to increase the validity and reliability of our tests. We should try to discourage over all options as far as possible. A good evaluation programme, besides aiming at the appraisals of achievement in different domains, must aim at educational diagnosis designed to locate specific learning and instructional difficulties, and if possible to determine their causes.

Improvement of Mechanics of examination and interpretation of score -

In order that the evaluation programme may be successful, careful thought will have to be given to the selection of paper setters and examiners, rules of grading etc.

The raw score which a pupil attain in a test has meaning only when some method of comparing his performance with that of other pupil is devised. So the raw scores must be converted into some more meaningful and comparable scores.

Extension of Evaluation Techniques - Since education is a process of desirable change and this change takes place in many dimensions, no evaluation programme will be complete unless all the aspects of students' progress are evaluated. For this, evaluation techniques have to be extended beyond prevalent written essay type examinations, to estimate accurately other areas of a pupils' personality. There are many devices which can be helpful in the appraisal of affective domain objectives. For example, observation, interviews, anecdotal records, group discussions, checklists etc. to supplement written examinations.

Consequential Corresponding Changes - An evaluation programme is interrelated with curriculum, because it is an integral part of guiding pupils' experience. The tests, cumulative record, and other tools by means of which evidence is gathered, provide basis for judging growth towards curriculum objectives. The evidence which is gathered, in turn affects the curriculum, by pointing those areas in which achievement is not as effective as desirable.

The cardinal principle of teaching - learning process should be that examination follows curriculum, not control it. But the gear is reversed in the prevalent system, which corrupts education in examination and teacher in examiner. As a result examinations have occupied a place out of all proportion in the educational process.

Few Words of Caution in the Evaluation of System of Examination.

In analysing system of examination and in our zeal of consequential reform we feel that there are certain areas in which we should be cautious.

(1) Examination should be guided by the present need of democratic society. With dawn of democracy, the goals of education have changed completely. The country needs education, which trains character to fit student to participate creatively as citizens; improves their practical and vocational efficiency, so that they may play their part in building up the economic prosperity of the country, and helps in development of their

Literary, artistic and cultural interests, which are necessary for self expression and for full development of personality, without which living National Culture cannot come into being.

Further secondary education being terminal for most of the pupils, the purpose of evaluation must change. Examination have to become a measure of assessing the successful completion of that stage, rather than merely selection for higher studies.

(2) Statistical Approach - The prevalent system of examination is criticised most due to the lack of reliability, validity, objectivity and discriminating power and new objective types of techniques are being adopted progressively, to minimise these defects. But their use requires careful handling, due to the difficulties and problems inherent in this job, especially to the most elusive problem - the human element - the examiner on one hand and examinee on the other. This difficulty is already been realised in Western countries where this technique has been in vogue for the last many decades. Regarding these techniques J.L. Brerton, Asstt. Secretary, University of Cambridge, Local Examination has to say, "I wish to make it clear that I do not under estimate the value of statistical methods in examination technique. On the contrary I think that without them it is impossible to devise an examination, which satisfies the primary condition of being 'fair'. Statistics in examination world should be seen, however, as an instrument of policy, any attempt to use them to make examination conform to abstract laws would be disastrous". Hence statistical approach to examination should be cautious one.*

(3) A National System of Examination - For many decades, examination, the world over, has been subjected to minutest scrutiny. Various types of examinations have been proposed, evolved and tried. If one was condemned another was put forth, applauded for a time and then discarded. The educational West is perhaps too much in the muddle to

* The case for Examination - J.L. Brerton -- P. 49.

understand where the fault lies. But we in India are differently placed. We have the privilege of knowing not only our own hoary and tenacious culture and values, but also those of West. This place of privilege gives India the right and charges her with the duty of not solving her own problem, but also of throwing fresh light on it from her own stand point.

To study the nature of the problem of examination, we must study the nature of educational system itself. This system is mainly built upon the nature and demands of life and literature of West. In this system, that examination is most reliable, which, eliminates the personality of the teacher. There are differences between East and West, but none where do we stand further apart than here. The Guru in India was Brahma himself. He was builder of humanity, he was rearer, he was the destroyer too. He was honest and dependable and it was he who was main factor in determining the success or failure of his students. It is against this back-ground that we have to view that supreme gift of India to the educational world is the teacher-pupil relationship. Examinations in India at every level were carried out under this spiritual relationship of the teacher and the pupil. The teacher knew his pupil, his weaknesses and ambitions. Learning did not carry a material connotation and, therefore, the teacher was more faithful to learning than to material.

A sound diagnosis, of the present examination system leads one beyond the system itself. The fault in examination lies in commercialised idealism and corrupt materialism of these aims and ideals, that gave birth to this system and maintain it. It lies in the peculiar meaning that examination conveys, and the peculiar values attached to it or to the examination certificate.* These are the forces which corrupt the teacher into

* The New Basis of Indian Educational Thought -Dr. G.W.Kaul - P. 62

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examiner and education in examination. The teacher seems to be the pole of the orbital system of examination. Unless he is the right person the system will fail. The failure or success of examination to large extent depend on him. Hence in any programme of examination reconstruction, his position must be in the fore front. He should be provided with every possible amenities and responsibilities. " It is a sound educational principle that it is only when responsibilities are given that responsible behaviour can be expected " *

To reorganise the system of examination in India, we shall have to take a wider view. We cannot reorganise it in isolation ignoring the existing educational system which has offered the evils or the present demands of our democracy and a wondering world upon our national genius or the new techniques developed in this field of examination or the ancient which provides a successful clue.

In our country the essay type examination is more predominating and researches are being done to improve them. As a result of the researches and at the recommendation of the various education commissions many new scheme have been adopted by the examining bodies. A programme of reformation needs a continuous evaluation and further research to determine the effectiveness of the incorporated schemes and techniques.

Hence, it would not be out of place if we discuss briefly the merits and demerits of essay type examination. This would further be helping us in our task of "Analysis of question papers".

* The New Basis of Indian Educational Thought - Dr. G.M.Kaul-P. 62

@ External Exams. in Secondary School, G.B.Jaffery, Chairman, Varsity Entrance School Exams, Council, University of London.

An essay examination may be defined as an examination in which questions call for answers to be written by students and allow students a significant degree of freedom in formulating their answers. Appropriate answers may be as several pages or as short as one sentence. In either case the student must determine how the answer is stated, and the way he expresses it is of concern to the examiner in assessing its quality.

The distinction is commonly made between examinations or questions of the essay type and those of the objective type. This choice of words is not ideal. It tends to confuse two important meanings of the word 'objective', and it seems to imply that essay examinations necessarily lack objectivity. Frequently they do, but their degree of objectivity is quite variable, depending on how questions are written and how answers are marked. It might be preferable, therefore, to refer to the one type as free-response questions and to the other type as fixed response questions.

Need for Improving.

Essay examination need to be improved. This type of examination is most used by educators and most criticized by evaluation specialists. It has often been noted that fixed response questions are difficult to prepare but easy to mark, while essay questions are easy to prepare but difficult to mark. A good fixed response question is easy to mark, and mark properly, because of the care which has been given to its formulation. It is also true of essay questions, though not to the same degree, that, when more care is given to their preparation, they can be marked, and marked properly with less difficulty. Essay examinations are used for a variety of purposes and include a variety of types. For examining students' proficiency in a language, an examination may consist of a single essay on the topic. Here the subject of the essay, and the

Information which students display about the subject, may be of less concern to the teacher than the way students express themselves in writing about it their choice of words, grammatical construction, formulation of sentences and paragraphs, organization of ideas etc.

Shortcomings of Essay Questions.

The principal weaknesses of essay examinations seem to be the following :-

- (1) The limited range of educational objectives to which questions are related.
- (2) Their vagueness or ambiguity .
- (3) Their lack of reliability.
- (4) Their limited coverage of topics or problems.
- (5) Their frequent inclusion of optional questions, so that students are not writing the same examination and their performance can not be validly compared.

Educational Objectives.

Essay questions are particularly well suited to testing students skill in written expression and their ability to think through problem and organise their thought in a clear and logical manner. To use essay questions for testing the recall of information is a great waste, for this type of achievement can be tested more efficiently with fixed response questions.

Higher levels of achievements such as depth of understanding , judgement, critical thinking, analysis, application of principles etc can be tested by fixed response questions or essay questions, if they are appropriately framed with such objectives in mind.

Every examination is a sampling process. It can include only a limited number of questions from the great number which might be asked

about the subject. If it is to be a broad and representative sample, the examination must be planned in advance. The planning involves decisions about the topics and concepts to be covered and the kinds of achievements to be tested. A useful device for this purpose is to prepare a chart showing the subject matter divisions in one dimension and the objectives to be tested in the other dimensions.

Thus for example, a paper-setter for an examination in General Science may decide that questions will be related to Biology, Chemistry, Geology, Physics etc, in certain specified proportions, and that a specified number of questions will be designed to test students ability to apply scientific principles. In designing these questions, careful attention should be paid to their wording so as students are clearly directed to make such applications. This is not accomplished by questions in such form as "Discuss -----", "Describe -----" or "Write short notes on -----". More appropriate are questions directing the students to "Explain -----", "Compare -----", "Illustrate -----" etc.

When questions are so designed as to require students to organise, synthesise and generalise, it is necessary of course, that students have time to think. This must be considered in determining as many questions students may be expected to answer in a given period of time. The number of questions that can be asked is limited at best, but paper-setters must realise that students can not be expected to provide thoughtful answers if they feel rushed to complete the examination.

Vagueness, Ambiguity.

Many essay questions are so stated that students can not know what kind of answer is desired several different kinds of answers may be justified and some of them may be quite different from what the teacher or paper-setter had in mind. This poses an extraneous problem for students.

Before they can formulate their answers, they have to guess, without adequate guidance, what the paper-setter means to ask. And, obviously, the diversity of their answers makes it difficult to mark the answers fairly.

An essay question should put before the students a clear task. They should know, with reasonable precision, what they are being asked to do. The purpose of an examination is to measure the competence of students in answering questions which they can understand. It is not our purpose to test their acuity in attempting to read the paper-setter's mind.

Frequently this means that the statement of the question should be longer, so that it gives more direction to students. It may also mean that answers may be shorter, because the scope of the task is clearly limited.

Some times students are at a loss to know whether a question should be answered, in a paragraph, a page, or several pages. When the statement of question itself does not impose fairly well defined limits, some indication of the desired length of the answer should be given.

Reliability.

One of the greatest problems concerning essay examination is that of deriving any kind of reliable marks from them. essay examinations have been notoriously unreliable. There are several types and sources of unreliability, of which the most significant are :-

- (1) The unreliability of an essay as an indication (sample) of the students competence and
- (2) the unreliability of marking answers.

The first of these problems arises particularly with reference to long essays, which are used primarily as tests of language skills.

In more common situations, however, the examination includes number of questions, sufficient to provide a reasonable sample of what a student can do. This problem needs attention when questions are introduced to test

greater variety of objectives. For example, if questions are used which call for application of principles, it would be wise to include more than one such question to increase the likelihood that his ability is reliably sampled.

The reliability problem that remains a serious one is that of reliable marking. In the case of reliable marking, essay examination has been highly unreliable. In many cases it has been found that different judges (all of them competent), see different degrees of quality in the same essay type answer, and it is not uncommon to find talented students frustrated at the unexpected result of the examination and ultimately cursing their fate.

Bright side of Essay-type Examination -

If properly constructed they can measure important out-comes of learning, which cannot be measured otherwise. They have other potential values and unique advantages such as testing higher mental processes like ability to organise, inter-relate and summarise. It is claimed for this type of examination that questions of the essay and discussion type test constructive ability as neither of other type of examination does.

The successful solution of the problems in this type of test depends upon other factors ; analysis of the whole, persistence in effort, power to look ahead, to take successive steps in reasoning, and that this latter is a power distinct that is required to take the single step in reasoning which questions set in the objective type of examination usually demand. Essay type of questions are easy to administer. They can be easily adopted to the various school subjects.

Need of Reform -

Examinations are not a thing wholly in themselves either good or bad. Their handling may be in proper or improper way.

It is for educationists to try to ensure that examination itself is of a kind which will be a help not a hindrance to the cause of true education. Assuming teaching to have been sound, and the pupils diligence fair, this ought on the face of it to issue in good general education. If it does not, is the examination to stand in the dock ? Analysis of prevalent examination clearly demonstrated lack of validity, reliability, objectivity, discriminating value etc.

To improve it needs reform in the following areas :

- (i) Improvement of written examination.
- (ii) Improvement of mechanics of examination.
- (iii) Improvement in the interpretation of scores.
- (iv) extension of the evaluation techniques to other areas of pupils growth.
- (v) Bringing about consequential changes in our educational system.

An article regarding examination reforms appeared in the daily ' Hitavada ' of 11th March, 1969 published from Bhopal tells us about the valuable views of authorities in the field of education. There in, the Union Education Minister Dr. V.K.R.V.Rao has been quoted. He says " that one of the objects of the new programmes for qualitative improvement of school education would be to ensure proper assessment of student's performance at the examinations. He has expressed himself in favour of doing away with the " century-old habit of awarding numerical marks to students " and substituting it with the " graded marking " system. Examination reform is one of these subjects that have always remained at merely the discussion level in our country. We hope that after due deliberation, Dr. Rao will take steps to implement what his Ministry considers to be an improvement over the existing system of examination and assessment both.

There is a general feeling in the country that there has been enough of tinkering with education and further experimentation should be

discouraged. However, even among those who are opposed to further changes in the system of our education, there is quite a sizable section that feels examination reform is overdue in our country.

One of the basic draw-backs in our present system of examination is the preponderance of narrative or descriptive type of answers in the written tests even in subjects in which they are not necessary. Another is the award of numerical marks. While there have been some efforts to remove the first draw back, no notable attempt has been made to substitute the numerical marks system with a better one.

The system of awarding numerical marks suffers mainly from the limited scope it provides for uniformity of assessment. With the rapidly growing number of students, necessitating proportionate increase in the number of examiners, the system is bound to call for replacement sooner than later. In some countries though the numerical marks system has been retained, the total number of marks which each test carries have been reduced to a figure as low as 5. The marks which a candidate gets out of the total of 5 may be broadly said to place him in the five categories of Distinction, First Class, Second Class, Third Class and Failed. The system has no doubt much to commend itself and is helpful for a judicious assessment of a student's application and ability. A major requirement of this system is the ability of the examiner to place each candidate precisely in the category he deserves to be, unlike the present elastic way of awarding marks out of a big total of say 100.

The system of awarding marks out of 5 could well be converted into the system of graded marking. The principal shortcoming of both these systems, however, is that they would make another test necessary whenever there is a competition for admission to institutions for higher education or for jobs. For instance, if the minimum grade needed for admission to an

engineering college in B, there would be several candidates with the same grade and their eligibility would have to be judged by additional tests to fix the order of placement for final selection.

It is to be hoped that all aspects of examination reform would be carefully studied before switching over to a new system from the existing one.

The Problem :

Much interest is being taken in the investigations at Secondary level and Higher Secondary level but it appears that in our Province none is much bothered about the Intermediate Examinations. The reason for this apathy (in-difference) might be due to the fact that Intermediate classes were abolished from colleges and schools after the change over of educational pattern from 12 years course to eleven years course of schooling before university courses. In the year 1958 this change was completed and regular coaching for intermediate examination was abandoned in schools. Students were allowed to appear at the intermediate examination as private candidates. Later on in 1965 a Correspondence Course ' for Intermediate Examination was started by the Board of Secondary Education M.P. Students who enrolled themselves as regular member of this course could only appear at the Intermediate Examination conducted by the Board. For some years students from other provinces were allowed to join this Correspondence Course' and appear at the examination, but now there are certain restrictions to this effect.

Any way the number of candidates appearing at the examination is quite large and they qualify themselves to join the two years degree course of the Universities after passing the

Intermediate Examination. Thus the importance of the 'Correspondance Course' can not be ignored. Even with all this market value none seems to me interested in investigation as to what is going on with the system of this examination. Being inspired by this attitude of indifference towards this examination I thought to set the ball rolling by investigating in a small field of this vast area. For my sake I have selected to investigate into the field of science examination and that too in the field of physics. I have limited my work only to carry out a systematic analysis of the question papers in physics during the last five years i.e. from 1964 - 1968 and find out the trends that are being followed in this setting of question papers and to judge their qualitative aspect or the present day criterion of 'Improved ways of testing'.

CHAPTER II.

PLAN AND PROCEDURE

Before discussing the ways and methods of organising the data collected for the analysis of the question papers, let us first of all make clear that our aim is to find out the extent to which the question papers satisfy the "Characteristics of a good examination". We know that a good examination should satisfy the following characteristics.

- 1/- Validity.
- 2/- Reliability.
- 3/- Practicability.

Validity refers to the attainment of the purposes for which the test is prepared. Physics is being taught at the Intermediate standard with certain objectives in view. If the examination can measure the attainment of these objectives for which it is designed, it is valid. Each question in the paper should be directed at some clear-cut objective which the examiner wants to assess. Thus different questions in the paper may be set with a view to assess different objectives kept in view while teaching the subject in the class. It is clear that at an external examination for Intermediate classes the questions should test the attainment of all important objectives viz.

- 1/- Knowledge of facts, concepts, principles and processes dealt with in the subject area.
- 2/- Application of Scientific knowledge gained during the study of the subject to life situations and special situations.
- 3/- Experimental and practical skills.
- 4/- Scientific Interests.

It is expected, that after completing the prescribed course of study through lessons and units, specially designed to meet the requirements of good instructional material. The examinees attained all objectives to some extent and some objectives to a higher extent. It is therefore, desirable that the questions paper should be directed to assess all the

important objectives mentioned above and a fair proportionate weightage should be given to these objectives. Of course the proportion of weightage largely depends on the decision already taken by the Board over the issue of weightage to different objectives, and instructions issued to the paper setter to that effect. This we shall have to take into account :-

- 1/- The syllabus prescribed by the Board.
- 2/- The objectives kept in view while imparting instructions.
- 3/- The weightage, if any, decided for different objectives.
- 4/- Validity of the questions in question papers of different years.

Reliability means the extent to which the test measures consistently.

Reliable test should give approximately the same score when given at different times. If a test is not reliable it is not valid then .

Reliability depends on (1) the length of the test ; (2) Objectivity of scoring ; & (3) Clarity of instructions.

In order to decide the reliability of the questions under consideration we shall have to take into consideration the first and the last point. We can discuss over the length of the test and also over the clarity of instructions, but we can not say any thing about the objectivity of the scoring as we do not have the instructions given to the examiners of the record of scores as awarded by individual examiners.

In order to decide about the length of the test we have distributed copies of the question paper to (1) Teachers who can teach Intermediate standard and (2) To students of who are to appear for an examination of the same standard i.e. XII class of Junior Colleges and B.Sc. Part I of University examination. We have asked them to give approximate time in minutes that they would require (in the case of students) or they would allow (in the case of teachers) for a full

answer of each question & its parts there off. In each paper the examiner is expected to answer seven questions and the time at his disposal is 180 minutes. Thus the average time for one question comes to 25-26 minutes. From the opinion of the students & the teachers we can know something about the length of the test.

To decide the clarity of instructions we have again asked the teachers and the students to grade the questions in the following categories:-

- (1) Clear.
- (2) Partly clear.
- (3) Ambiguous.
- (4) Not clear.

Question with clear instructions, without any scope of receiving different answers (technically) are to be marked " Clear ". Questions containing clear instructions for a part of it ambiguity for the next of it as " Partly Clear " A question which can be answered with different view points as " Ambiguous " and the question having nothing specific about its scope or direction as " Not Clear ". In fact the sampling in deciding the " length of the test " and " Clarity of instructions " is not a very large one , but still it may give us some idea regarding the reliability of the test.

Practicability :- The usefulness of a test depends upon how well the test lends itself to ease of administration, scoring, interpretation and application. For the purpose of administration we have to satisfy that the test can be adjusted.

- (1) Within time limits .
- (2) With in economy limites in the use of material.
- (3) With in the limites of objectivity of scoring.
- (4) to prove useful in using and interpreting the test results.

For deciding practicability of the test, we have to limit our probing into the whole affairs. It being a final and external examination the practicability of it as it appears was not given any serious consideration. Specially the objectivity of scoring " and " interpretation of test results of their application were totally neglected. No discussions ever followed the examination results or no publicity was ever given to the views and suggestions given by the examiners in their " Report " which is a compulsory item to be furnished by them and without which they are not entitled for remuneration. In fact an analysis of the suggestions made and views expressed by the examiners would have been of immense help in improving the quality of test but it might have been ever looked because the examination was a concern of private candidates only and the instructions were being imparted by an efficient body known as " Correspondence Courses Committee " . Thus we have no base to comment on the "objectivity of scoring and interpretation of the test results".

As regards " time limit " we have already enquired from teachers and students to give their estimate of the time needed for answering the full questions. A study of their response will decide the practicability of the test regarding time limit.

As far as the point of " Economy " is concerned these tests have been fully upto the mark. No extra material besides question paper and answer - book was needed for the test. No graphs, drawing sheets or other extra technical aids were needed in any of the papers during these five years. And thus the tests were within the expected limits of economy.

Objectives of Teaching Physics.

- I. The pupil will acquire knowledge of facts, concepts and principles in the field of physics.

Specifications.

The pupil will.

1. recall facts, principles, properties etc.
2. recognise different scientific instruments, devices etc.

- II. The pupil will develop understanding of various fact principles, physical phenomenon etc. in physics.

Specifications.

The pupil will

1. Illustrate a certain phenomenon or principle by an example.
2. give proofs both experimental and theoretical where available.
3. discriminate between related concepts and instruments,
4. compare and contrast the related concepts and find out similarities and dis-similarities between them,
5. express a given scientific idea or statement in different ways,
6. identify an error in a given statement or in arrangement of apparatus and remedy the same,
7. judge the adequacy of the given data for the solution of a problem in getting at a result,
8. use appropriate units to express various quantity
9. assess the various sources of error and minimise them as far as possible.

III Application.

The pupil will apply his knowledge to solve problems in a new or unfamiliar situation.

Specifications.

The pupil will

1. give an explanation of a certain happening or a phenomenon,
2. substantiate his arguments by due reasoning,
3. develop new experimental procedure to test or verify a given situation or a hypothesis.
4. modify or develop an alternative experimental procedure to test or verify the knowledge of situation,
5. suggest a plan to improvise a scientific appliance.
6. predict a happening and infer results from a given relevant data.
7. find new uses of various appliances known to him.

IV

Skills.

The pupil will develop

- A. Experimental skill.
- B. drawing skill.

A.

Experimental skill.Specifications.

The pupil will

1. show a keen sense of observation in taking reading and judging arrangement and parts of apparatus,
2. handle the instruments and arrange them in a proper situation,
3. clean and maintain the instruments properly,
4. reset the apparatus where necessary.
5. repair different appliances available in the laboratory and also in daily life.
6. improvise simple equipment.
7. open and re-assemble some simple instruments.

B. Drawing skills.

The pupil will draw graphs, charts and prepare tables.

Specifications.

The pupil will show

1. the sense of proportion in drawing various parts of the apparatus.
2. draw the diagrams in the same sequence and organization according to the actual arrangement of the apparatus.
3. draw diagrams with reasonable accuracy and speed.
4. use proper technique and instruments in drawing diagrams.
5. select suitable scales to draw graphs so that the maximum available space is used.
6. construct tables and charts to record and present the data in an effective manner.
7. intelligence to take care to measurements and observe precautions in all practical measurements.

Plan & Procedure.

The analysis of question papers is done with a view to find out the extent to which the question papers full fills the requirements of a good test. We have to find out (1) the content coverage, (2) The weightage given to objectives, (3) Form of the questions, (4) Time limit to solve them (5) Difficulty level (6) Language and (7) The quantity of the questions as a whole (As far as the content coverage, weightage to different objectives and form of the question is concerned there may not be any difference of opinion.) In content coverage we try to find out the number of topics & sub topics that are covered by the question paper . A good question paper must include questions touching as many topics as possible from the prescribed syllabus. This can only be attained by asking short answers questions and fixed response questions. This may increase the number of questions but a judicious distribution of marks and selection of questions will definitely improve the quality of the question paper. In deciding the " content coverage " There are practically no chances for difference of opinion hence this has been done by me alone.

As teaching without any objective is no teaching similarly testing without objective is no testing. The main purpose of evaluation is to test the extent to which the objective, have been achieved though regular teaching. For this no questions must be objective based. The main objectives that we include (1) Knowledge (2) Understanding (3) Application & (4) Skill. In fact equal weightage must be given to achieve these objectives during regular course of teaching and equal weightage must also be given to these objectives in the testing programme. The language and the phrasing of the question indicates the objective that it wants to test. There are practically no chances of difference of opinion in deciding the objectives that are being tested by a question

hence I have myself analysed the questions in physics and sorted out the objective that have been covered by them.

The form of the question is generally of three types

(1) Essay type (2) Short answer type & (3) fixed response type (objective type)
Each type has got its own peculiarity merits & demerits. A judicious combination of these three types of question may make a test very effective. It is not difficult to decide the form of a question by reading of course there are chances where ambiguous phrasing may make it difficult to decide the length of the answer required or the number facts to be included in the answer. But mostly the form is obvious by the language used hence I have sorted out the questions into these forms simply by reading the language and phrasing used in these question.

The fraction of time limit is also very important, because it decides the practicability of the test. The total time allotted to each question paper in physics is 5 hrs. and mostly the students are required to answer seven question. Thus they approximately get 25 mts for one question. But the time limit for each question may vary with individual. Hence to decide it I obtained opinion of average students and the teacher actually teaching the subject to these classes. For my sampling I selected fifty students and fifty teacher from Bhopal proper and the adjoining area .

The difficulty level of a test may also vary with individually and to have some reliable idea of the difficulty level of the questions in physics I had the some group of teachers and students to decide the difficulty level of these question papers. For simplifying the whole procedure only three levels of difficulty were fixed (1) Difficult, (2) Average Difficult (3) Easy. I have used the mean of the responses received from the students and teachers. The language and phrasing of a test also plays an important part in deciding its quality. Many a times it happens that while preparing a test the examiner has a different idea

in his mind and expects a particular type of response. But the phrasing or the language is being defective or ambiguous the desired response is not received and thus the examinee is put to a loss. In order to decide the definiteness of the phrasing of a question I again obtained opinions of the same fifty teacher and students. Three categories were fixed to test the phrasing of a question - (1) Definite (2) Indefinite (3) Partly definite. Questions which contain only one part may either be definite or indefinite but question containing more than one part may be definite in one part and ambiguous or indefinite in the others. Such questions are to be included into 'Partly definite Category'.

Having decided the above mentioned fraction of test the sum total effect of all these give it a quantity which places a test in the rank of " perfect ; good or bad test. For the sake of convenience. The question are ranked as A, B, & C . Opinion of the same group of teachers and students has to be sought in deciding the " sum total quality of questions in each question papers.

As mentioned above, I had to gather opinion of teachers and students over the issue of (1) time limit ; (2) Difficulty level (3) language & phrasing of questions, & the quality of question. For collecting their opinion I supplied the teachers and students a copy of the syllabus, a copy of question papers and a printed proforma with clear instructions regarding the method of filling in their opinion in the proforma. I personally contacted these students and teachers and explained them the purpose of my study and the importance of their unbiased opinion in arriving at some definite and important conclusions. They were also explained the way in which they were to fill in their opinion in the proforma supplied.

For collecting opinion I selected a group of five students and five teacher for each question paper . The total number of question paper under study being ten the total number of students and teachers involved in the sampling was 50 each.

For simplifying the tabulation and organisation of the data the groups were given following symbols.

TA	1	64	(Teachers Group one dealing with I paper of 1964)
TA	2	64	(" Two " II ")
TB	1	65	(" Three " I " 1965)
TB	2	65	(" Four " II ")
TC	1	66	(" Five " I " 1966)
TC	2	66	(" Six " II ")
TD	1	67	(" Seven " I " 67)
TD	2	67	(" Eight " II ")
TE	1	68	(" Nine " I " 68)
TE	2	68	(" Ten " II " 68)
SA	1	64	(Students group one dealing with paper I of 1964)
SA	2	64	(" Two " " II ")
SB	1	65	(" Three " " I " 65)
SB	2	65	(" Four " " II ")
SC	1	66	(" Five " " I 1966)
SC	2	66	(" Six " " II ")
SD	1	67	(" Seven " " I 1967)
SD	2	67	(" Eight " " II ")
SE	1	68	(" Nine " " I 1968)
SE	2	68	(" Ten " " II ")

Each teacher group consisted of five teachers and each student group was also made of 5 students. Thus there were fifty students and fifty teachers from whom necessary information and opinions were collected.

I personally met with each group and explained the importance of their

impartial and unbiased opinion. I supplied each member of each group with (1) a copy of question paper with which they were concerned (2) a copy of the syllabus prescribed by the board ; (3) a proforma which they were required to fill in and a copy of the general instructions that they were to follow. I explained the way in which the prescribed proforma was to be filled in by the students and the teachers . I also explained them the meaning of the abbreviations used in connection with the proforma, for example.

T = Time limit in minutes.

DL = Difficulty level and D₁ = difficult.
AV = Average difficult, E = easy.

L = Language D = Definite, Id = indefinite,
Pd = Partly definite.

Q = Quality of the question, A = First Quality
B = Second quality
C = Third quality.

Each individual member of the groups was given a week's time to study the syllabus and the question paper and to fill in the preformas . In the second round I personally collected the preformas completely filled by these students and teachers.

The data supplied by TA 1 and SA 1 was compiled together and the mean value of the answers to each item was found . The sheets prepared showing questionwise analysis of each paper, contain this mean value obtained from the responses received from the students and teacher groups. Thus in all I prepared 10 sheets on the basis of responses received. Similarly (TA 2 , SA 2) (TB 1 , SB 1), (TB 2 , SB 2) and so on were combined together.

	1964		1965		1966		1967		1968	
	I	II	I	II	I	II	I	II	I	II

T	→	→	→	→	→	→	→	→	→	→
D	→	→	→	→	→	→	→	→	→	→
L	→	→	→	→	→	→	→	→	→	→
Q	→	→	→	→	→	→	→	→	→	→

T	→	→	→	→	→	→	→	→	→	→
D	→	→	→	→	→	→	→	→	→	→
L	→	→	→	→	→	→	→	→	→	→
Q	→	→	→	→	→	→	→	→	→	→

T	→	→	→	→	→	→	→	→	→	→
D	→	→	→	→	→	→	→	→	→	→
L	→	→	→	→	→	→	→	→	→	→
Q	→	→	→	→	→	→	→	→	→	→

The following instructions were issued alongwith the proforma which was to be filled in by the teachers and students .

Instructions :- (1) You are requested to study each question of the question paper supplied to you and give your frank opinion about the following points .

- a) Time in minutes that an average student would need to answer each question or its parts satisfactory.
- b) Difficulty level of each question or of its parts for an average students . If the question is difficult you would use D_1 to denote it, AV would denote average difficult and E stands for an easy question.
- c) You have to judge the language of each question and if you find it definite please denote it by D ; indefinite by Id and if partly definite then by Pd .
- d) Lastly you have to judge the quality of each question as a whole " If you find that the question tests real achievements of the students and falls the characteristics of a good question you would place it in class A. You may classify the questions in class A, B and C in the diminishing order of quality.

At the top of the proforma you are requested to write your name qualifications experience (for teachers only) and age. This information would be kept confidential if so desired.

The proforma contains 11 horizontal wide rows each divided into 4 narrow rows,. Each wide row is for one question ; and each narrow row is for the different aspects related to the question for examples the first wide row is for 1st question and the 1st narrow row is for time factor (T) the second narrow row is for Difficulty level (D_2) the third narrow row is for the language aspect of the question (2) and

the fourth narrow row is the quality as a whole of the question (Q)

Thus has been repeated in all wide rows.

The broad vertical columns are for years and each of them is divided into two narrow columns, one for 1st paper and the second for second for second paper.

Please see the year marked on the question paper and fill in the relevant information in the proper column. The other columns pertaining to question papers of other years may be left blank.

CHAPTER III

**COLLECTION, ORGANISATION AND
INTERPRETATION OF THE DATA.**

INTERMEDIATE EXAMINATION, 1964.

P H Y S I C S

First Paper

Time - 3 hours

Maximum Marks- 35

Note:- Attempt only Seven questions of which not more than two may be from Section A and not more than three from each of the Sections B and C.

Section 'A'

1. Give the construction and working of a spherometer. How would you determine the focal length of a convex lens with its help? Prove the formula used.
2. Differentiate between Isothermal and Adiabatic changes. Obtain a relation between the isothermal and adiabatic elasticities of a perfect gas.
3. State Archimedes' principle and describe how it can be proved experimentally.

A block of wood of specific gravity 0.85 floats in water. Some kerosene of specific gravity 0.82 is poured on the surface of water until the wooden block is completely immersed. Calculate the fraction of the block lying below the surface of water.

Section 'B'

4. Describe with a neat diagram a constant volume gas thermometer and explain how it can be used to determine melting point of wax.
5. Explain clearly how the determination of Dew-point leads you to an estimate of relative humidity of air.

Enumerate various common hygrometers and describe the one you consider to be the most accurate.

6. Prove the gas equation $PV = RT$

Calculate the value of gas constant for 1 gm. of air

(Density of air at N.T.P = 0.001293 gm./c.c.)

7. Define Emissive and Absorptive power of a surface.

How can it be experimentally shown that for any surface

Emissive and Absorptive powers are equal ?

Section 'C'

8. A candle flame is viewed through (a) a prism and (b) a plate of glass with parallel sides. Explain with the aid of neat diagrams the apparent position of the candle as seen by the eye.

A vessel of depth $2d$ is half filled with a liquid of refractive index μ and the other half by a liquid of refractive index μ' . Find the apparent depth of the vessel when viewed normally.

9. Show that the power of two thin lenses in contact is the sum of the powers of each of them.

What is the power of a lens, which, when combined with a converging lens of focal length 25 cms., will produce a combination power of 2 dioptres.

10. How could you produce dispersion without deviation ?

Describe with a sectional diagram and instrument for studying spectra based on the above principle.

11. Describe the construction of an astronomical telescope.

What modification will make it suitable for terrestrial purposes ? Find its magnifying power.

Question-wise Analysis

1964 - Paper I

S.No.	Objective	Specification	Topic	Form	Marks	Language	Quality
1.	Understanding knowledge.	Problem solving Recall.	Spherometer	Essay	5	M	B
2.	Knowledge	Recall	Elasticity of gases	Essay	5	I	B
3.	Knowledge understanding	Recall Judge the adequacy of the data	Archimedes Principle	Essay	5	M	C
4.	Skill knowledge	Draw Diagram Recall	Thermometry	Essay	5	I	B
5.	Knowledge	Recall	Hygrometry	Essay	5	M	B
6.	knowledge	Recall	Gas Equation	Essay	5	I	B
7.	Knowledge	Recall	Radiation	Essay	5	I	B
8.	Knowledge understanding skill	Recall Problem solving Drawing diagram	Refraction	Essay	5	I	C
9.	Understanding	Problem Solving	Lenses	Essay	5	I	B
10.	Knowledge skill	Recall Drawing diagram	Dispersion	Essay	5	I	C
11.	Knowledge Application	Recall Modification of Apparatus	Optical Instrument	Essay	5	I	C
						M	C

Questionwise Analysis
1964 - Paper I.

Response received from groups TA-1 & SA-1

Q.No.	Time required	Difficulty level.	Language	Quality
1.	20 minutes	E	Pd	B
2.	23 do	Av	D	B
3.	15 do	E	Pd	C
4.	20 do	Av	D	B
5.	25 do	Av	Pd	B
6.	15 do	Av	D	B
7.	20 do	Av	D	C
8.	15 do	D	D	B
9.	20 do	D	D	C
10.	20 do	Av	D	C
11.	25 do	Av	Pd	C

INTERMEDIATE EXAMINATION, 1965

P H Y S I C S

First Paper .

Time -3 Hours

Maximum Marks- 35

Note :- Attempt only Seven question out of the following eleven questions of which not more than two may be from Section A and not more than three from each of the Sections B and C. All questions carry equal marks .

Section 'A'

1. State Boyle's Law.

A uniform capillary tube open at one end and closed at the other, has a column of air enclosed in it by a pellet of mercury 5 inches long. If the length of the air column is x inches when the open end is downwards, the tube being vertical and $(x-2)$ inches when the tube is held vertically with the open end upwards, calculate the atmospheric pressure.

2. State and explain Newton's laws of motion giving some illustrative examples. Show how the unit of force has been obtained from the second law.
3. Explain the principle of Nicholson's Hydrometer. How would you use it to determine the specific gravity of (a) a solid lighter than water and (b) sugar candy.

Section 'B'

4. Define the coefficients of apparent and real expansion of a liquid. Derive the relationship between them. Describe how a weight thermometer is used for determining the coefficient of apparent expansion of a liquid.
5. Describe, with a diagram, the Bunsen's ice calorimeter and explain how it can be used to measure the density of ice.

6. Describe Searle's method for the determination of the mechanical equivalent of heat.

If a waterfall is 200 metres high, what will be the difference in temperature of water at the top and at the bottom?

7. Define co-efficient of thermal conductivity of a material.

A hollow sphere of metal of 12 cm. external radius and 1 cm. thick is filled with melting ice and is kept surrounded by water at 10°C .

How much ice would melt in a minute? ($K = 0.02$; Latent heat of ice = 80 cal/g.)

Section 'C'

8. When a mirror turns through an angle, the reflected ray, for the same incident ray turns through twice that angle. Prove this. In the lamp and scale method of measuring deflections the distance from scale to mirror was 2 metres. If the deflection along the scale was 50 mm. find in degrees the angle through which the mirror turned. If the scale can be read to 0.5 mm., calculate the smallest measurable angular deflection of the mirror.
9. Obtain the formula for refraction at a convex spherical surface. Hence derive the lens equation.
10. Classify the different types of spectra and give examples of each. Describe the nature of solar spectrum and explain the origin of Fraunhofer's lines.
11. Trace the direction of rays in the following cases :-
- Galilean Telescope.
 - Compound Microscope.

Question-wise Analysis.1965 First Paper

SB-1.

S. No.	Objective	Specification	Topic	Form	Marks	Languages.		Quality
1.	Knowledge understanding	Recall Solving a problem.	General properties gas laws.	Essay	5			
2.	Knowledge understanding	Recall gives illustrations.	Laws of motion.	Essay	5	D		B
3.	Knowledge application.	Recall Experimental situation.	Hydrometer.	Essay	5	D		A
4.	Knowledge.	Recall & recognition.	Expansion of liquids (Heat)	Essay	5	Pd		B
5.	Knowledge understanding Application.	Description of instrument and its use in new situation.	Specific Heat.	Essay	5	D		B
6.	Knowledge understanding	Recall solving a problem.	Mechanical equivalent of heat.	Essay	5	Pd		C
7.	Knowledge understanding	Recall problem solving.	Thermal conductivity.	Essay	5	Pd		A
8.	Understanding	Problem solving	Light reflection at plane surfaces.	Essay	5	Pd		B
9.	Understanding.	Mathematical relationship.	Refraction through spherical surfaces.	Essay	5	Pd		C
10.	Knowledge.	Recall	Dispersion (Light)	Essay	5			
11.	Skill	Drawing.	Optical instruments.	Practical Drawing.	5			

Questionwise Analysis

1965 — Paper I

Response received from Groups TB-1 & SB-1.

Q.No.	Time required to solve the question.		Difficulty level	Language.	Quality
1.	20	minutes	E	D	B
2.	25	do	E	D	A
3.	15	do	E	Pd	B
4.	25	do	E	D	C
5.	25	do	Av	D	B
6.	20	do	Av	Pd	C
7.	20	do	Av	Pd	A
8.	20	do	D	Pd	B
9.	25	do	D	Pd	C
10	25	do	D	Pd	B
11.	25	do	E	Id	C

INTERMEDIATE EXAMINATION, 1966.

P H Y S I C S

First Paper

Time - 3 hours

Maximum Marks- 50.

Notes:- Attempt only Seven questions of which not more than two may be from Section A and not more than three from each of the Sections B and C. All questions carry equal marks.

Section 'A'

1. (a) What is meant by Resolution of force: ?
 (b) Explain why it is easier to pull a lawn roller than to push it.
 (c) Explain with the aid of diagram the flight of a kite.
2. (a) Define Power.
 (b) Prove that 1 H.P. = 746 watts.
 (c) An engine is used to pump 22,000 gallons of water per hour through a vertical height of 100 ft. Find the H.P. of the engine (1 gallon of water = 10 lbs).
3. (a) Prove that the Isothermal Elasticity of a gas is equal to its pressure.
 (b) Give the working of the McLeod Gauge in the measurement of very low pressure.

Section 'B'

4. Describe Joly's Steam Calorimeter and explain how may be used to determine the specific heat of a gas at constant volume.
5. (a) Describe Regnault's hygrometer with the help of a diagram and explain how you use it to determine relative humidity.
 (b) Give its advantages.

6. (a) Define Emissive power and Absorption co-efficient.
 (a) Describe Ritchie's apparatus to show that the emissive power of a surface is equal to its absorptive power.
7. (a) Prove $J (C_p - C_v) = R$
 (b) The specific heat of air at constant volume is 0.1684 and at constant pressure is 0.2375. Calculate the value of 'J' Density of air at N.T.P. = .001293 gm/cc

Section 'C'

8. (a) Describe Foucault's method for determining the velocity of light.
 (b) A beam of light is reflected by a rotating mirror on a fixed mirror which sends it back to the rotating mirror from which it is again reflected and makes an angle of 18° with its original direction. The distance between the two mirrors is 10 cms. and the rotating mirror is making 375 rev./sec. Calculate the velocity of light.
9. (a) What are the two principal defects of vision. Explain how they are rectified with the help of spectacles.
 (b) A person can not see object nearer than 75 cms. What is the power and the nature of the lens he should use to see objects at 25 cms?
10. (a) Define Total Internal reflection.
 (b) Describe Pulfrich's method for the determination of refractive index of a liquid.
11. (a) Describe Bunsen's Grease photometer and explain its working.
 (b) A standard Candle and a lamp produce the same intensity of illumination when their distances from a screen are 16 cms. and 80 cms. respectively. Find the candle power of the lamp.

Question-wise Analysis.

1986 - First Paper.

S. No.	Objective	Specification	Topic	Form	Marks	Language	Quality
1. a)	Knowledge	Recall.	Resolution of forces.	Essay type	5		
b)	Understanding	Stating Principles.					
c)	Understanding & Skill.	Stating Principles Drawing diagram				Pa	B
2. a)	Knowledge	Simple recall	Energy & Power.	Essay type	5	Pa	C
b)	Knowledge					Pa	C
c)	Understanding	Problem solving.					
3. a)	Knowledge	Recall-mathematical relation	Elasticity of gases.	Essay type	5	Pa	C
b)	Knowledge	Recall Principles.				Id	B
4.	Knowledge	Recall working of apparatus	Calorimetry	Essay type	5	Id	C
5. a)	Knowledge	Recall construction of apparatus	Hygrometry	Essay type	5	D	C
b)	Knowledge.					D	C
6. a)	Knowledge.	Recall definis	Heat Radiation	Essay type	5		B
b)	Knowledge	Recall the & working of apparatus					B
7. a)	Knowledge	Recall mathematical relationship.	Mechanical equivalent of Heat.	Essay type	5		
b)	Understanding.						
8. a)	Knowledge.	Recall construction of apparatus					
b)	Understanding	Problem solving	Velocity of light	Essay type.	5		

3.	Objective.	Specification	Topic	Form	Marks
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9. a) Understanding

b) Understanding.

Problem
solving.

Aspects of
vision.

Essay
type

5

10. a) Knowledge

Recall
defines time
turns

Refractive
index.

Essay
type

5

11. a) Knowledge

Recall-
describes
apparatus

b) Understanding.

Problem
solving.

Photometry

Essay
type

5

Questionnaire Analysis

1966 -- Paper I

Responses received from groups Te-1 & Sc-1.

Q.No.	Time required	Difficulty level	Language	Quality
1.	25 minutes	Av	Pa	B
2.	20 do	Av	Pa	C
3.	30 do	DL	Pa	C
4.	20 do	Av	Pa	C
5.	20 do	Av	Id	B
6.	25 do	Av	Id	C
7.	25 do	Bv	D	C
8.	25 do	Av	D	C
9.	20 do	Av	D	B
10.	20 do	Av	Pa	B
11.	30 do	E	Pa	B

INTERMEDIATE EXAMINATION, 1967.

P H Y S I C S

First Paper

(Properties of Matter, Heat and Light)

Time - 3 hours

Maximum Marks - 35.

Note :- Attempt only Seven questions of which not more than two may be from Section A and not more than three from each of the Sections B and C. All questions carry equal marks.

Section 'A'

1. (a) Define pitch and least count of a micrometer screw.
- (b) A screw gauge is to be used for measurements accurate to $\frac{1}{100}$ of a mm. Calculate the number of divisions on its cap if the pitch of the screw is $\frac{1}{2}$ mm.
- (c) State the law of gravitation. Distinguish between the gravitational constant G and the acceleration due to gravity g , on the surface of the earth.
2. (a) What is co-efficient of friction ? Does it change with the area of contact ?
- (b) How will you find out the volume of a solid by making use of Archimedes Principle ?
- (c) Draw the diagram of a Fortin's barometer ; explain how it is used to calculate the atmospheric pressure.
3. (a) State Hooke's law. Explain what is elastic limit.
- (b) Describe a method for the determination of Young's modulus of a wire.
- (c) What is surface tension ?
Explain how a needle can be made to float on water.

Section 'B'

4. (a) What are the desirable properties of a liquid for a 'Liquid-in-glass' thermometer ? Explain how far :-
 (i) Mercury ;
 (ii) alcohol ; and
 (iii) Water satisfy these requirements.
- (b) Describe a method to determine directly the co-efficient of real expansion of mercury.
5. (a) Prove the relation.

$$pV = RT$$
- (b) The weight of one litre of air at N.T.P. is 1.293 gm.
 What is the weight of 4 litres of air at temperature 27°C and pressure 750 mm ?
6. (a) Define co-efficient of thermal conductivity.
- (b) What do you mean by 'steady state' in conductivity experiments ?
- (c) Describe Searle's method for the determination of conductivity of a good conductor.
7. (a) State Newton's Law of cooling. What are its limitations ?
- (b) How will you verify the law in the laboratory ?
- (c) What is the principle of the thermopile ? Why is one set of its junctions blackened and the other set shielded ?

Section 'C'

8. (a) Prove the relation.

$$\mu = \frac{\sin \frac{A + \delta_m}{2}}{\sin \frac{A}{2}}, \text{ for a prism.}$$

- (b) A ray of light is passing through a glass prism whose angle is 60°. The angle of minimum deviation obtained is 44°. What is the index of refraction of glass ? ($\sin 52^\circ = .7880$).

9. (a) With the help of diagram, compare and contrast the astronomical telescope with the Galilean telescope.
- (b) With the help of a neat diagram, explain the construction, working and use of a spectrometer.
10. (a) Describe Fizeau's method for the determination of velocity of light.
- (b) In a Fizeau experiment, the distance between the wheel and the distant mirror is 7380 metres and the first eclipse occurs when the wheel, which has 720 teeth, makes 15.75 revolutions per second. Calculate the velocity of light.
11. Write notes on any two of the following :-
 - (a) Pulfrich refractometer.
 - (b) Measurement of small deflections.
 - (c) Defects of vision.

Question-wise Analysis.

1967- Paper I

Q. No.	Objective	Specification	Topic	Form	Marks
1.	a) Knowledge.	Recall	Micrometer	Short Ans.	1
	b) understanding.	problem solving.	" "	Essay	1
	c) Knowledge	Recall	Gravitation	Essay	1
2.	a) Knowledge	Recall	Friction	Short Ans.	1
	b) Knowledge	Principle	Arch.	Essay	5
	c) Skill	Drawing Around diagram	Barometer	Essay	1
3.	a) Knowledge	Recall	Elasticity	Essay	1
	b) Knowledge	Recall	Elasticity	Essay	1
	c) Knowledge	Recall	Surface tension.	Essay	1
4.	a) Knowledge	Recall	Thermometer	Essay	1
	b) Knowledge	Recall	Coeff. of Expansion of liquid.	Essay	1
5.	a) Knowledge	Recall	Gas Equation.	Essay	1
	b) Understanding	problem solving	on Gas Equation.	Essay	1
6.	a) Knowledge	Recall	Conduction	Short Ans.	1
	b) Knowledge	Recall	"	Essay	1
	c) Knowledge	Recall	"	Essay	1
7.	a) Knowledge	Recall	Law of cooling	Essay	1
	b) Knowledge	"	"	Essay	1
	c) Knowledge.	"	Thermopile	Essay	1
8.	a) Knowledge	Recall	Ref. Index	Essay	1
	b) Understanding	problem solving.	"	Essay	1
9.	a) Knowledge skill	Recall Drawing diagram	Optical Instrl.	Essay	1
	b) Knowledge Skill	Recall Drawing "	"	Essay	1

Question-wise Analysis.

1967 - Paper I

S. No.	Objective	Specification	Topic	Form	Marks
10. a)	Knowledge	Recall	Vel of light	Essay	5
b)	Understanding.	Problem of a living.	Vel of light	Essay	1
11. a)	Knowledge	Recall	Refraction	Essay	2½
b)	Knowledge	Recall	Mirror & scal arrangement.	Essay	2½
c)	Knowledge	Recall	Eye & its defects.	Essay	2½

Questionwise Analysis

1987 -- Paper I.

Response received from groups TD-1 & SH-1.

Q.No.	Time required	Difficulty level	Language	Quality
1.	20 minutes	E	D	A
2.	20 do	E	D	B
3.	25 do	E	Pd	C
4.	25 do	E	Id	B
5.	20 do	E	Pd	C
6.	20 do	E	Pd	B
7.	25 do	E	D	C
8.	25 do	E	Pd	B
9.	20 do	E	D	C
10.	25 do	Av	Pd	C
11.	25 do	Av	Pd	B

Intermediate Examination 1968.

PHYSICS

FIRST PAPER

Time Allowed - 3 Hours

Maximum Marks - 55

Note :- Attempt only Seven questions of which not more than two may be from Section A and not more than three from each of the Sections B and C.

All questions carry equal marks.

Section 'A'

1. (a) Explain the principle of the vernier. On the main scale of a vernier callipers one inch is divided into 16 equal divisions. If the least count of the vernier is 0.0125 of an inch, establish a relation between the vernier and main scale divisions.
- (b) Define Mechanical advantage and Velocity ratio. Show that for a lever the mechanical advantage is equal to its velocity ratio.
2. (a) State and explain Newton's three laws of motion. A box whose mass is 350 gm. rests on a smooth table. A steady horizontal force is applied to the box. After 5 seconds the box has acquired a speed of 40 cm/sec. Determine the horizontal force acting on the box.
- (b) Describe how you will determine the specific gravity of a liquid with the help of a Nicholson's hydrometer.
3. Write notes on two of the following :-
 - (a) Simple harmonic motion ;
 - (b) Determination of Young's modulus ;
 - (c) Fortin's Barometer.

Section 'B'

4. (a) A rigid-iron pendulum is made of 5 iron rods and 4 brass rods. Each of the brass rods is 50 cms. in length. Find the length of each iron rod. Co-efficient of linear expansion for iron is 0.000012 and that for brass is 0.000018.
- (b) Describe a constant volume air thermometer and compare it with a mercury thermometer.
5. Describe Joly's steam calorimeter. How is it modified to determine the specific heat of a gas at constant volume ?
6. (a) Describe a steam engine.
- (b) State Newton's law of cooling and give its experimental verification.
7. Write notes on two of the following :-
- (a) Weight thermometer ;
- (b) Critical temperature and pressure of gases ;
- (c) Convection and its applications.

Section 'C'

8. (a) Define refractive index. Prove that the refractive index of a material is equal to the ratio of the real depth and the apparent depth.
- (b) If A and B are the sizes of the image for the two positions of the lens in the displacement method of determining the focal length of a convex lens, show that the size of the object is equal to $\sqrt{AB}$.
9. (a) Define magnifying power of a telescope and obtain an expression for the same.
- (b) Describe Foucault's method for determining the velocity of light.

10. (a) With the help of diagrams describe the various defects of the eye and explain how these are corrected.
- (b) A person can not see objects distinctly at a distance less than a metre. Calculate the power in dioptres of the spectacles that he should use in order to read a book at a distance of 25 cm.
11. Write notes on two of the following :-
- (a) Bunsen's gross-spot Photometer ;
- (b) Total internal reflection and refractive index ;
- (c) Spectrometer and its uses.

Question-wise Analysis.1963- First Paper.

Q. Objective N.	Specification	Topic	Form	Marks		
					Language	Quality
1. a) Understanding	Problem solving	Vernier	Essay	5		
b) Knowledge	Recall	Machine	Essay			
2. a) Knowledge	Recall	Laws of	Essay	5	D	C
Understanding	Problem solving	motion				
b) Knowledge	Recall	N.Hydro- motor	Essay		D	B
3. a) Knowledge	Recall	S.H.M.	Essay		D	B
b) Knowledge	Recall	Elasticity	Essay			
c) Knowledge.	Recall	Barometer	Essay		Pd	B
4. a) Understanding	Problem solving	Coeff. of	Essay	5	Id	A
b) Knowledge	Recall	Expansion Thermomet	Essay			
5. Knowledge	Recall	Calorime-	Essay	5	Id	D
Application.	Modification of App.	try.			Pd	B
6. a) Knowledge	Recall	Steam	Essay	5		
b) Knowledge	Recall	Engine. Laws of	Essay		Pd	C
7. A) Knowledge	Recall	cooling Thermometry	Essay		Id	C
b) Knowledge	Recall	Liquidificat-	Essay			
c) Knowledge	Recall	ion of gases Convection	Essay		Pd	B
8. a) Knowledge	Recall	Refraction	Essay		Id	B
b) Understanding	Problem solving	lenses	Essay	5		
9. Knowledge.	Recall	Magnification	Essay	5		
b) Knowledge.	Recall.	Vel. of light	Essay			
10. a) Knowledge	Recall	Defects of	Essay	5		
b) Understanding	Problem Solving	vision. Defects of	Essay			
11. a) Knowledge	Recall	vision. Photometry	Essay			
b) Knowledge	Recall	Refraction	Essay			
c) Knowledge	Recall	Dispersion	Essay			

Questionwise Analysis

1988 -- Paper I

Response received from group TE-1 & SE-1.

Q.No.	Time required		Difficulty level	Language	Quality
1.	25	minutes	Av	D	C
2.	30	do	Av	D	B
3.	35	do	Av	D	B
4.	20	do	E	Pd	B
5.	20	do	E	Id	A
6.	25	do	E	Id	D
7.	20	do	Av	Pd	B
8.	20	do	E	Pd	C
9.	25	do	Av	Id	C
10	25	do	Av	Pd	B
11.	30	do	Av	Id	B

INTERMEDIATE EXAMINATION, 1964.

P H Y S I C S

Second Paper

Time - 3 hours.

Maximum Marks- 55

Note :- Not more than Seven questions are to be attempted, two from Section A and five from Section B. All questions carry equal marks.

Section 'A'

1. What are stationary waves ?

Explain graphically how these waves are formed.

Distinguish clearly between a progressive and a stationary wave.

2. State the laws of transverse vibration of strings and describe how these laws could be experimentally verified with the help of a sonometer.

A stretched wire under tension of 4 kgm-weight is in unison with a fork of frequency 520. What alteration in tension would make the wire vibrate in unison with a fork of frequency 256 ?

3. What are beats ? How are they produced ? Illustrate your answer by suitable diagrams.

Calculate the velocity of sound in a gas in which two waves of length 1 and 1.01 metres produce 10 beats in 5 seconds.

Section 'B'

4. Deduce an expression for the magnetic field at a point on the axis of a bar magnet.

A short bar magnet is placed in the magnetic meridian with its north pole pointing south. The neutral point is 24 cm north of the south pole of the magnet and upon the prolongation of its axis. Find the intensity of the field at a point on the axis 20 cm. from the south pole and north of it.

(Horizontal component of the earth's field, $H = 0.18$ Gauss).

5. Describe a lip-circle.

How will you measure the 'angle of dip' at a place correctly? Mention the errors that may arise and explain how they can be eliminated.

6. Three condensers of capacity 1, 2 and 3 micro-farads are connected such that the second and third are in series and the first is in parallel with them. Calculate the resultant capacity.

Derive the formula used.

7. Distinguish between electromotive force and potential difference as applied to a cell.

Give the principle of a potentiometer. Show how you will use it to compare the e.m.f's of two cells.

8. Describe, with necessary theory, a galvanometer of the moving-coil type and explain its action.

What are the special merits of this galvanometer?

9. An electric lamp has a resistance of 400 Ohms. It is connected to supply mains of 200 volts. If the price of electric energy is 12 paise per kilowatt-hour, calculate the cost of lighting the lamp for 10 hours.

10. Write an essay on "Discharge of Electricity through Gases".

11. Write notes on any three of the following :

- (a) Lissajous figures.
- (b) Wheatstone bridge.
- (c) Lead accumulators.
- (d) Electro-magnetic induction.
- (e) Triode valves.

Question-wise Analysis.

1964 Second Paper.

S.No.	Objective	Specification	Topic	Form	Marks
1.	Knowledge understanding skill.	Recall Differentiation Drawing skill	(Sound) Waves Progressive & stationary.	Essay	5
2.	Knowledge understanding.	Recall of Principals problem solving.	Vibration of strings (Sound)	Essay	5
3.	Knowledge & skill & understanding.	Recall Diagram drawing numerical problem solving.	Production beats (Sound)	Essay	5
4.	Knowledge & understanding.	Numerical problem solving.	Magnetism field due to a magnet.	Essay	5
5.	Knowledge	Recall & discription of an apparatus.	Dipcircle Magnetism	Essay	5
6.	Understanding	Problem solving and deduction of mathematical relationship.	Electricity condensers.	Essay	5
7.	Knowledge & application.	Recall of a principle and its use in solving a problem.	Comparison of E.M.F. (Electricity)	Essay	5
8.	Knowledge	Recall of Principles.	Galvanometer (Electricity)	Essay	5
9.	Knowledge & understanding.	Recall & problem solving.	Heating effect of Electric current.	Essay	5
10.	Knowledge.	Recall.	Discharge through gases (Electricity)	Essay	5
11.	a) Knowledge b) Knowledge. c) Knowledge. d) Knowledge. e) Knowledge.	Recall.	Sound Electricity Short Circuit Lead accumulator. notes each E.M. Induction.	Short One	5

Questionwise Analysis

1964 -- Paper II

Response received from Groups TA-2 & SA-2.

Q.No.	Time required to solve the question.		Difficulty level	Language.	Quality.
1.	25	minutes	E	Pd	B
2.	20	do	E	Pd	B
3.	25	do	E	Pd	B
4.	15	do	E	Pd	C
5.	20	do	E	Pd	C
6.	25	do	E	Id	C
7.	20	do	E	Id	B
8.	25	do	E	D	C
9.	20	do	E	Pd	B
10.	25	do	E	Id	C
11.	20	do	E	Id	B

INTERMEDIATE EXAMINATION, 1965

P H Y S I C S

Second Paper

Time - 3 hours

Maximum Marks - 35

Note :- Not more than seven questions are to be attempted out of the following Eleven question ; two from Section A and five from Section B.

All questions carry equal marks.

Section 'A'.

1. What are Lissajous figures ? Find out the resultant of two S.H.'s of the same period at right angles to each other and having a phase difference of $\frac{\pi}{2}$.
2. Define frequency, pitch and quality.
Describe the rotating drum method of finding out the frequency of a tuning fork.
3. An observer sets his watch by the sound of a signal gun fired from a distant tower. He finds that his watch is slow by two seconds. Calculate the distance of the tower from the observer.
The temperature of the air during observation is 15 C and the velocity of sound in air at 0 C is 332 metres/sec.

Section 'B'

4. Derive an expression for the moment of a couple on a bar magnet placed in a uniform field of intensity H with its axis inclined to the field at angle

Calculate in C.G.S. units the couple on a bar magnet 4 cms. Long with poles each of 150 units strength when placed with its axis at right angles to a uniform magnetic field of intensity 0.18 gauss.

5. Describe the method of verification of inverse Square Law of Magnetism by Searle's needle and Robison magnet, deriving the formula used.
6. Derive an expression for the electric potential at a point distant r cm from a point charge
7. Give the construction and working of a tangent galvanometer. Calculate the current in amperes passing through a tangent galvanometer of 50 turns and mean diameter 22 cm. When the needle is deflected through an angle of 30° in the Earth's horizontal field of magnitude 0.3

$$\left[\tan 30 = \frac{1}{x} \right]$$

8. What are the conditions for obtaining a balance in Wheatstone bridge experiment ?
A battery of negligible internal resistance and e.m.f. 4 volts is connected to the opposite corners A and C of a quadrilateral wire frame ABCD. The resistance of the side AB is 90 ohms, of BC 110 ohms, of CD 60 ohms and of DA 40 ohms. Calculate the potential difference between B and D.
9. What is (a) local action, (b) polarisation ?
in
Explain the chemical reactions going on in a Daniel Cell and how the above defects are removed in it ?
10. How are X-rays produced ? Explain their nature and give their properties.
11. (a) What is magnetic equator ?
(b) What is the magnitude and direction of resultant magnetic field at a neutral point ?

- (c) If an earthed metallic plate is brought near an insulated charged conductor, will the potential, charge and capacity of the latter increase, decrease or remain constant ?
- (d) In an induction coil why is the e.m.f. generated in the secondary more at the break than at the make ?
- (e) What is the main difference between a diode and a triode valve ?

Question-wise Analysis1965. Second Paper.

Q. Objective No.	Specific tion	Topic	Form	Marks
1. Knowledge & Understanding.	Recall Problem solving	Lissajous figures (Sound)	Essay	5
2. Knowledge.	Recall.	Rotating mirror method (Sound)	Essay	5
3. Understanding.	Problem solving.	Velocity of sound.	Essay (Numerical)	5
4. Understanding.	Mathematical relations established.	Magnetism (moment of) a couple	Long (Numerical)	5
5. Knowledge.	Recall.	Inversesquare Law. (Magnetism)	Essay	5
6. Understanding.	Mathematical relation established.	Electrical potential.	Essay	5
7. Knowledge & understanding.	Recall problem solving.	Darwin galvanometer	Essay	5
8. Knowledge & understanding.	Problem solving.	Wheatstone bridge.	Essay long (Numerical)	5
9. Knowledge	Recall & Recognition.	Simple Cells	Essay (Electricity)	5
10. Knowledge.	Recall	X-ray	Essay	5
11. a) Knowledge.	Recall	Magnetism	Short answer.	1
b) Knowledge.	"	Magnetism	"	1
c) Knowledge.	"	Electricity	"	1
d) Knowledge	"	"	"	1
e) Knowledge.	"	"	"	1

Questionwise Analysis

1965 -- Paper II

Response received from groups TB-1. & SB-2.

Q.No.	Time required	Difficulty level	Language	Quality
1.	25 minutes	E	Pd	B
2.	25 do	E	Pd	B
3.	20 do	E	Pd	B
4.	20 do	D	D	C
5.	25 do	E	Pd	C
6.	25 do	E	Pd	B
7.	20 do	E	Pd	B
8.	20 do	E	Pd	B
9.	20 do	E	D	B
10.	25 do	Av	D	B
11.	30 do	Av	Iv	B

INTERMEDIATE EXAMINATION, 1966.

P H Y S I C S

Second Paper .

Time - 3 hours

Maximum Marks- 35

Note:- Attempt two questions from Section A and five from Section B. All questions carry equal marks.

Section 'A'

1. What are stationary waves ? How are they produced ?
Enumerate their chief characteristics. Illustrate your answer by diagrams.
2. Describe the falling plate method of measuring the frequency of a tuning fork. Derive the formula used.
3. With the help of a Kundt's tube how would you determine the velocity of sound in a metal supplied to you in the form of a rod ;
assuming that the velocity of sound in air is known. What elastic constant can be obtained from your results and how will you calculate it ?

Section 'B'

4. State inverse square law of magnetic force. Briefly describe the deflection magnetometer method of verifying it . Draw neat diagrams showing forces acting on the needle one for tan A position and one for tan B position.

Or

Define the intensity of a magnetic field at a point. Find an expression for the intensity of magnetic field due to a bar magnet at a point (i) lying along its axis and (ii) lying along the perpendicular to the axis passing through the centre of the magnet.

5. (a) How is the horizontal component of earth's field measured in the laboratory? Give full theory.
- (b) If the horizontal and vertical component at a place are 0.3 Gauss and 0.4 Gauss, find the total intensity of earth's magnetic field.

6. What do you understand by electric potential at a point?

Calculate the potential at a point distant r cm. from a point charge of $+q$ e.s.u.

Or

Define capacity of a conductor. Obtain an expression for the capacity of a parallel plate air condenser. What is the effect of introducing, between the plates, a slab of dielectric constant K ?

7. Describe a tangent galvanometer. How will you use it to compare the electromotive forces of two cells by sum and difference method. Draw connection diagrams and prove the formula?

Or

You are given an ammeter and a voltmeter. Explain how will you find the internal resistance of a cell. Prove the formula and draw the connection diagram. Is your method suitable for finding the internal resistance of an accumulator? Give reasons.

8. (a) State Faraday's laws of electrolysis. Define electro-chemical equivalent of an element.
- (b) The electro-chemical equivalent of hydrogen is 0.00001045 gm/coulomb. How much hydrogen will be liberated during the electrolysis of water when 10 ampere current is passed for 10 hours.
9. (a) Define the terms 'Power' and 'Kilowatt Hour'.
- (b) An electric kettle takes 4 amperes when put on a circuit of 220 volts. Calculate the time required to prepare two cups of tea with 450 gm. of water to be heated from 20°C to 100°C.
($J = 4.2 \times 10^7$ ergs/cal.)

Question-wise Analysis.1988- Second Paper.

Q. No.	Objective	Specification	Topic	Form	Marks
1.	Knowledge	Recall	Sound Stationary waves	Essay	5
2.	Knowledge.	Recall	Sound frequency determination	Essay	5
3.	Knowledge & understanding	Recall & Problem solving.	Sound velocity.	Essay	5
4.	Knowledge	Recall	Magnetism magnetometer tan A & tan B position.	Essay	5
	Knowledge	Recall			
5. a)	Knowledge	Recall	Magnetism Earth's component.	Essay	5
	b) understanding	Problem solving.			
6.	Knowledge	Recall.	Electricity	Essay	5
	Knowledge	Recall.	Electrical potential capacity of conductor.		
7.	Knowledge	Recall	Electricity Galvanometer.	Essay	5
	Understanding & application.	Problem solving.	Ammeter & volt		
8. a)	Knowledge	Recall	Electricity	Essay	5
	b) Skill.	Problem solving.	of electrolysis	Essay	
9. a)	Knowledge	Recall.	Electricity units of Electricity.	Essay	5
	b) understanding	Problem solving			
10.	Knowledge	Recall	Electricity	Essay	5
	Knowledge.	Recall	A-C Dynamo X-ray	Essay	

Questionwise Analysis

1966 -- Paper II

Response received from groups TU-2, & SC-2.

Q.No.	Time required	Difficulty level	Language	Quality
1.	30 minutes	E	Pd	B
2.	30 do	Av	Pd	B
3.	30 do	A Av	D	C
4.	30 do	Av	Pd	C
5.	35 do	E	Pd	B
6.	30 do	Av	Pd	B
7.	15 do	Av	Id	C
8.	20 do	Av	Id	C
9.	25 do	E	Pd	C
10.	20 do	Av	Pd	B

INTERMEDIATE EXAMINATION, 1967

PHYSICS

(Sound, Electricity and Magnetism)

SECOND PAPER

Time - 3 hours

Maximum Marks - 35

Note :- Attempt Seven questions only of which two should be from Section A and five from Section B out of the following Ten questions. All questions carry equal marks.

Section 'A'

1. Describe the possible modes of vibration of air column in a closed organ pipe.
Show how the frequencies of overtones are related to that of the fundamental note.
2. Give a brief account of the various methods of determining the pitch of the note emitted by a given tuning fork.
3. Write short notes on any two of the following :-
 - (a) Kundt's tube ;
 - (b) Resonance ;
 - (c) Tempered scale ;
 - (d) Beats ;
 - (e) Echo.

Section 'B'

4. What is (a) Local action. (b) Polarisation ?
Explain the chemical reaction going on in a Daniell Cell and how the above defects are removed in it ?
5. Derive an expression for the moment of a couple on a bar magnet placed in a uniform field of intensity H with its axis inclined to the field at an angle θ

Calculate in C.G.S. units the couple on a bar magnet 4 cms. long with poles each of 150 units strength placed with its axis at right angles to a uniform magnetic field of intensity 0.19 gauss.

6. Calculate the capacity of condensers when connected in (i) Series and (ii) Parallels.

Or

Show that the capacity of the two parallel plates each of an area A separated by a distance d is given by

$$C = \frac{KA}{4\pi d}$$

7. Trace the following :-

- (i) Magnetic field due to a linear current.
- (ii) magnetic field due to a circular current.
- (iii) magnetic field due to current in a solenoid.

State the rule giving the strength of the magnetic field at a point due to a short element of current and calculate the magnetic field at the centre of a circular coil through which a current is flowing.

8. State Ohm's law and describe how this can be verified.

Or

Explain the principle of a Wheatstone's Bridge. Show how you would apply it in practice to determine the resistance of a conductor.

9. Describe the production and properties of X-rays.

10. Write notes on any two of the following :-

- (a) Radium and radio-activity.
- (b) Diode valve
- (c) Telegraph
- (d) Telephone.
- (e) Thermocouple.

Question-wise Analysis.1967- Second Paper.

S. No.	Objective	Specification	Topic	Form	Marks
1.	Knowledge.	Recall	Vibration of Air column.	Essay	5
2.	Knowledge.	Recall.	Frequency of Tuning Fork.	Essay	5
3.	a) Knowledge.	Recall.	Kundt's Tube.	Essay	2½
	b) Knowledge.	Recall	Resonance.	Essay	2½
	c) Knowledge.	Recall	Musical scale	Essay	2½
	d) Knowledge.	Recall.	Reats.	Essay	2½
	e) Knowledge.	Recall.	Echo	Essay	2½
4.	Knowledge	Recall.	Simple Cell.	Essay	5
5.	Knowledge. Understanding.	Recall Problem solving.	Magn. Moment.	Essay	5
6.	Knowledge	Recall.	Condensers	Essay	5
6.	Knowledge.	Recall.	Condensers.	Essay	5
7.	Knowledge.	Recall	Magnetic effects of current.	Essay	5
8.	Knowledge	Recall	Ohm's Law	Essay	5
8.	Knowledge.	Recall	Wheat's Bridge.	Essay	5
9.	Knowledge	Recall	Discharge through gases.	Essay	5
10a.	Knowledge.	Recall.	Radio Activity	Essay	2½
	b) Knowledge	Recall	Radio valve	Essay	2½
	c) Knowledge	Recall.	Telegraphy	Essay	2½
	d) Knowledge.	Recall.	Telephone	Essay	2½
	e). Knowledge.	Recall.	Thermo couple.	Essay	2½

Questionwise Analysis

1967 -- Paper II

Response received from groups -- TD-2 & SD-2.

Q.No.	Time required	Difficulty level	Language	Quality
1.	20, minutes	D1	Pd	B
2.	20 do	D1	Id	B
3.	25 do	Av	Id	B
4.	25 do	Av	Id	C
5.	25 do	Av	Pd	C
6.	20 do	Av	Pd	C
7.	20 do	B	Id	B
8.	25 do	B	Id	C
9.	25 do	Av	Pd	B
10.	20 do	B	Pd	C

INTERMEDIATE EXAMINATION, 1968.

P H Y S I C S

Second Paper

Time Allowed - 3 hours

Maximum Marks - 35

Note :- Attempt Seven questions only of which two should be from Section A and five from Section B

All questions carry equal marks.

Section 'A'

1. (a) Explain the effect of change of density, temperature and pressure of a gas on the velocity of sound.
(b) Calculate the velocity of sound in hydrogen gas assuming the velocity in air to be 332 metres per second. (Weight of 1 litre of hydrogen = 0.0896 gm ; weight of 1 litre of air = 1.293 gm.)
2. Describe a spherometer and explain its working. Show how it is used to determine the frequency of a tuning fork.
3. Write short notes on any two of the following :-
(a) Beats ;
(b) Nodes and antinodes ;
(c) Resonance ;
(d) Pitch and quality .

Section 'B'

4. Describe a vibration magnetometer. How will you compare the intensities of two magnetic fields with it ?
Derive the necessary formula.
5. Explain what you understand from the following :-
(a) The Earth's Horizontal Intensity at Bhopal is 0.35 gauss.
(b) The declination at a place is 80 E-
(c) The dip at Calcutta is 22.

6. Define : Electro-static capacity of a conductor and specific Inductive capacity.

Show that the capacity of a spherical conductor is numerically equal to its radius.

7. (a) Explain the construction and working of a tangent galvanometer.
 (b) Why is this instrument most sensitive when the deflection is 45° ?
 (c) Why should the magnetic needle at the centre of the coil be small ?

8. (a) What is specific resistance ? What are the units of specific resistance ?

- (b) Describe the laboratory method of determining specific resistance of the material of a wire.

9. (a) Define : Joule, Watt, Board of Trade Unit .

- (b) Calculate the resistance of an electric bulb marked 220 V, 40 W.

10. Write short notes on any two of the following :-

- (a) Cathode Ray ;
 (b) Structure of Atom ;
 (c) Local Action and Polarisation ;
 (d) Moving Coil Galvanometer .

Question-wise Analysis.1968- Second Paper.

S. No.	Objective	Specification	Topic	Form	Marks
1. a)	Knowledge	Recall	Vel of Sound	Essay	1 5
b)	Understanding	Problem solving	Vel of Sound.	Essay	1 1
2.	Knowledge	Recall	Monometer.	Essay	5
3. a)	Knowledge.	Recall	Beats	Essay	2½
b)	Knowledge	Recall	Notes & Antinotes.	Essay	2½
c)	Knowledge.	Recall	Resonance.	Essay	2½
d)	Knowledge	Recall	Pitched	Essay	2½
4.	Knowledge	Recall	Magnetometer	Essay	5
5. a)	Understanding.	Recognition facts.	Earth Horizon-tal	Short Ans	
b)	Understanding.	" "	Declination.	"	5
c)	Understanding.	" "	Dip	Short Ans.	
6.	Knowledge	Recall	Capacity of condenser.	Essay	5
7. a)	Knowledge	Recall	T.Galvano-meter.	Essay	1 5
b)	Understanding.	Principles.	" "	Short Ans.	1 1
c)	Understanding.	Understanding	" "	Short Ans.	1 1
8. a)	Knowledge	Recall	Sp.Resistance.	Essay	1 5
b)	Knowledge	Recall	" "	Essay	1 1
9. a)	Knowledge	Recall	Elec.Units.	Short Ans.	1 5
b)	Understanding.	Problem solving.	Resistance of bulb.	Essay	1 1
10. a)	Knowledge	Recall	Discharge of Electricity.	Essay	2½
b)	Knowledge	Recall	Structure of Atom.	Essay	2½
c)	Knowledge.	Recall	Defects of simple cell.	Essay	2½
d)	Knowledge.	Recall	Galvanometer.	Essay	2½

Questionwise Analysis

1968 -- Paper II

Response received from groups TE-2 & SE-2.

Q.No.	Time required	Difficulty level	Language	Quality
1.	20 minutes	Av	D	B
2.	20 do	Av	D	B
3.	25 do	Av	Id	C
4 .	25 do	B	Id	B
5.	25 do	B	Id	A
6.	20 do	Av	Pd	B
7 .	20 do	B	Pd	C
8.	20 do	Av	D	C
9.	25 do	Av	Id	B
10.	25 do	B	Id	B
11.				

S Y L L A B U S

For the sake of convenience the syllabus in Physics had to be divided into Topics and sub Topics. The Topics & the sub Topics had to be numbered so that the number of topics & sub topics covered by the question papers each year may easily be indicated, both graphically and in numerals.

Thus the ^{portions} ~~pertain~~ " properties of matter", was divided into 8 main topics and 63 sub topics. The ^{portion} ~~pertain~~ of Heat was divided into 8 main topics and 50 sub topics and the ^{portion} ~~pertain~~ of "Light" was divided into 7 main topics and 34 subtopics. Since these three ~~portions~~ constitute the first paper, it can be seen that the first paper ~~would~~ was to cover 147 sub topics and 23 main topics. The maximum marks for this paper were fixed as 35. Thus an area of knowledge consisting of 147 topics was to be weighed against 35 marks.

Similarly the ~~pertain~~ of "Sound" was divided into 7 main and 30 sub topics, the ~~pertain~~ of magnetism into 5 main and 29 sub topics and the ~~pertain~~ of " electricity into 17 main & 87 sub topics. These three ~~pertain~~ constitute, The Second paper, Hence it is apparent that this second paper would cover 146 sub topics and 29 main topics. As far as the number of sub topics is concerned luckily in both papers it is practically the same. In second paper, also, these 146 sub topics are to be weighed againd 35 marks.

Thus taking into consideration the number of sub-topics the six different portions rank as below :

1/-	Electricity	17 Topics -	87 sub Topics.
2/-	General properties of matter.	8 " -	68 "
3/-	Heat.	- 8 " -	50 "
4/-	Light	- 7 " -	34 "
5/-	Sound	- 7 " -	30 "
6/-	Magnetism	- 5 " -	29 "

In fact the weightage of marks ought to have been according to the number of topics in each portion, and thus a satisfactory division of marks would be as below -

1/-	Electricity	87 Sub Topics	-	21 Marks.
2/-	General Properties.	63 "	-	15 "
3/-	Heat.	50 "	-	12 "
4/-	Light.	34 "	-	8 "
5/-	Sound.	30 "	-	7 "
6/-	Magnetism.	29 "	-	7 "

Thus in the First Paper the three Sections could have been as below :-

Section	A	-	General Properties of matter	15 Marks.
Section	B	-	Heat.	12 "
Section	C	-	Light.	8 "
Total				35 Marks

and in the Second Paper the ~~three~~ ^{then} Sections could have been as -

Section	A	-	Electricity.	21 Marks.
Section	B	-	Magnetism.	7 "
Section.	C	-	Sound	7 "
Total				35 Marks

Analysis of Paper First - Showing details of syllabus
covered during the year 1964-68.

			1964			1965			1966			1967			1968			reference given to Topics during 5 years.
Sec tio n.	No. of To pi es	Topics	No of Sub Top ics	No. of Su To pi es Co ve red	Mar ks of All ote d	No. of Sub Top ics d	Mar ks of All ote d	Sub top ics	Mar ks of All ote d	Sub Top ics	Mar ks of All ote d	Sub Top ics	Mar ks of All ote d	Sub Top ics	Mar ks of All ote d			
A	1	General Properties	5	1	5	0	0	0	0	1	3	1	2½	3/5	II			
	2	Statics	13	0	0	0	0	2	5	0	0	1	2½	2/5	III			
	3	Friction	3	0	0	0	0	0	0	1	1½	0	0	1/5	IV			
	4	Dynamics	15	0	0	1	5	3	5	2	2	2	5	4/5	I			
	5	Elasticity	5	1	5	0	0	1	2	2	3	1	2½	4/5	I			
	6	Pressure (Liquid & Air)	14	0	0	1	5	2	3	2	4	1	2½	4/5	I			
	7	Principle Archimedes	3	3	5	0	0	0	0	1	3/2	0	0	2/5	III			
	8	Hydrometers.	5	0	0	3	5	0	0	0	0	1	2½	2/5	III			
Total Sub topics covered			65	5	15	5	15	8	15	9	15	7	17½					
Total No. of topics			6	3		3		4		6		6						
B	1	Heat & Temp.	5	0	0	0	0	0	0	3	2½	1	1	2/5	III			
	2	Expansion of Solid & liquids.	7	0	0	1	5	0	0	1	2½	2	5	3/5	II			
	3	Gas Equation	3	3	10	0	0	0	0	1	5	1	2	3/5	II			
	4	Calorimetry	7	0	0	1	5	1	5	1	3	2	7½	4/5	I			
	5	Critical pressure Temperature	5	0	0	0	0	0	0	0	0	2	2	1/5	IV			
	6	Hygrometry	5	4	5	0	0	1	5	0	0	0	0	2/5	III			
	7	Mechanical Equivalent J	4	0	0	1	5	1	5	0	0	1	2½	3/5	II			
	8	Conduction	4	0	0	1	5	0	0	3	5	0	0	2/5	III			
		Convection	1	0	0	0	0	0	0	0	0	1	2½	1/5	IV			

Sound :-

1-2 Sub Topics out of 8 have not yet been included.

All topics out of 7 have been included at-least once.

Magnetism.

15 Sub topics out of 29 have not yet been included.

One topic out of 5 has not been asked during these five years.

Electricity :

44 Sub topics out of 87 have not yet been included.

One topic out of 17 has not been asked during these five years.

Analysis of Paper Second - Showing details of Syllabus
Covered during the years 1964-69.

		1964		1965		1966		1967		1968			
No.	Topics	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	Reference	
of		of	of	of	of	of	of	of	of	of	of	given to	
to		Sub	Sub	All	Sub	All	Sub	All	Sub	All	Sub	topics during	
the		Top	Top	the	Top	the	Top	the	Top	the	Top	5 years.	
the		ics	ics	d	ics	d	ics	d	ics	d	ics	d	
of		Cov	Cov		Cov		Cov		Cov		Cov		
the		are	are		are		are		are		are		
of		d	d		d		d		d		d		
1	Conductors & Capacity.	6	0	0	2	6	2	7	0	0	2	5½	3/5 III
2	Condensers & capacity.	7	2	5	0	0	1	3	2	10	1	1½	4/5 II
3	Atomospheric Electricity.	2	0	0	0	0	0	0	0	0	0	0	VI
4	Primary Cells.	7	0	0	3	5	0	0	3	5	1	2½	3/5 III
5	Magnetic effect of electric current	8	0	0	1	5	1	3	3	5½	3	5	4/5 II
6	Ohm's law & application.	7	0	0	0	0	0	0	1	5	1	5	2/5 IV
7	T-Galvanometer.	2	0	0	0	0	1	2½	0	0	0	0	1/5 V
8	Wheatston's Bridge.	5	1	1½	1	5	0	0	1	5	0	0	3/5 III
9	Galvanometers	5	1	5	0	0	1	4	0	0	1	2½	3/5 III
10	Potentiometer.	2	2	5	0	0	0	0	0	0	0	0	1/5 V
11	Electrolysis	7	1	1½	0	0	3	6	0	0	0	0	2/5 IV
12	Heating effects.	9	2	5	0	0	1	5	1	2½	1	5	4/5 II
13	Electromagnetic Induction.	6	1	1½	1	1	0	0	0	0	0	0	2/5 IV
14	A.C. & D.C. Motors.	5	0	0	0	0	2	5	0	0	0	0	1/5 V
15	Application of Electric magnetism	4	0	0	0	0	0	0	2	5	0	0	1/5 V
16	New Physics.	4	1	5	1	5	1	5	2	7½	1	2½	5/5 I
17	Electronics.	3	1	2	2	1	0	0	1	2½	1	2½	4/5 II
Total sub.Topics Covered.		67	12	31½	11	28	13	40½	16	49	12	30	
Total No. of topics covered.		17	9		7		9		9		9		
		146	23	58	25	55	23	70½	26	78½	25	60	
		29	17		16		15		15		16		

Analysis of Paper Second - Showing details of Syllabus
Covered during the years 1964-68.

		1964		1965		1966		1967		1968				
S	No.	Topics	No.	No.	Mar	No.	Mar	No.	Mar	No.	Mar	Reference		
e	of		of	of	of	of	of	of	of	of	of	given to		
c	To		Sub	Sub	All	Sub	All	Sub	All	Sub	All	topics during		
t	li		Top	Top	ots	Top	ots	Top	ots	Top	ots	5 Years.		
i	cs		ics	ics	d	ics	d	ics	d	ics	d			
e			Cov	Cov		Cov		Cov		Cov				
n			ere	ere	d	ere	d	ere	d	ere	d			
A	1	Production & Velocity of sound.	8	1	2½	1	5	0	0	0	0	1	5	5/5 III
	2	Wave motion	5	5	5	1	5	1	5	0	0	1	2½+2½	4/5 II
	3	S.H.M.	5	0	0	2	4	0	0	0	0	0	0	1/5 IV
	4	Sonometer.	3	1	2½	1	2	0	0	1	2½	3	5	4/5 II
	5	Vibration of strings & air coils	6	2	5	0	0	1	5	3	10	1	2½	4/5 II
	6	Musical Sound	2	0	0	0	0	0	0	1	2½	0	0	1/5 IV
	7	Miscellaneous Topics.	4	1	1½	1	1	1	5	3	7½	1	2½	5/5 I
Total sub Topics covered			30	8	16½	6	15	5	15	8	22½	6	20	
Total No. of Topics covered.			7	5		5		5		4		5		
B	1	Magnet & its properties.	5	0	0	0	0	0	0	0	0	0	0	IV
	2	Magnetic field & factors influence	6	1	2	1	5	1	1	1	5	0	0	4/5 I
	3	Tangent law & magnetometer.	7	1	3	1	2	4	9	1	2	0	0	4/5 I
	4	Vibration Magnetometer.	6	0	0	2	5	0	0	0	0	2	5	2/5 III
	5	Terrestrial Magnetism.	5	1	5	2	2	2	5	0	0	5	5	4/5 I
Total Sub topics covered.			29	5	10	6	12	7	15	2	5	5	10	
Total No. of topics covered.			5	5		4		5		2		2		

		1964			1965		1966		1967		1968			
Sr. No. of Topics	No. of Topics	No. of Sub-Topics	No. of Sub-Topics	Mar All etc d	No. of Sub-Topics	Mar All etc d	Sub Top ics	Mar ks All etc d	Sub Top ics	Mar ks All etc d	Sub Top ics	Mar ks All etc d	Preference given to Topics during 5 ye rs.	

C O N T E N T - C O V E R A G E

An attempt has been made to represent graphically the "Content Coverage" in each paper. For this purpose six separate sheets have been prepared. Each sheet presents vividly the story of each section of physics included in both papers during these five years.

Sheet No. 1 - is for General properties of matter.

Sheet No. 2 - - Heat.

Sheet No. 3 - - Light.

These three sheets combined together form First Paper.

Sheet No. 4 - is for sound.

Sheet No. 5 - is for Magnetism.

Sheet No. 6 - is for Electricity.

These three sheets combined together form the Second Paper.

Scheme of study for each sheet, and sheet No. 1 in particular on the horizontal line these are small black columns. Below each column a sub topic has been written. Thus one black column represents, One sub topic. A number of sub topics taken together form a topic and at the bottom the topics have also been mentioned. The column Scheme is violetred for 1964, Bright red for 1965, Brown for 1966, yellow for 1967 and green for 1968.

Thus in sheet No. 1 there are 63 sub topics and 8 topics.

Above the horizontal line of sub-topics there are five horizontal belts of equal width of 5 small units. Each belt represents the content coverage of each year i.e. 1964, 65, 66, 67 & 1968. The width of each belt (5 small units) represents. 5 marks every year almost in all papers, each question has been allotted 5 marks irrespective of the parts or sections it contains there in. Where a single question on one sub-topic has been asked a coloured column of 5 units length has been placed over the "black column" representing the respective sub topic. For example in 1964,

there is one full question on spherometer and one full question on ^{Adiabatic} ~~Adiabatic~~ and Isothermal elasticity. Hence one coloured column has been placed on sub topic No. 5 and one coloured column in between sub topic 38-39.

There is only one question which deals with the topic Archimedes Principle and covers all the three sub topics and hence the full question has been arbitrarily divided into three parts and allotted 1,2,2 marks respectively. The total thus remain 5 marks for the full question. Thus a careful glance will show that only five sub topics have been covered out of 63 and 15 marks have been allotted to them. A vast blank pertain on this belt makes it clear that much of the content area remained untouched.

In a similar way if we study the belt representing 1965 we find that again there were five sub topics touched and 15 marks allotted to them. One interesting aspect may be noticed that there is a regular shifting of not of the columns either to the right or to the left of the columns of the previous belt. This indicates the tendency of the paper setter to exclude that content area which has been touched in the previous year.

There is a gradual increase in the number of sub topics covered in the year 1966 and 67. They are 8 and 9 respectively. In the year 1968 there are 7 sub topics.

Now looking at all the five belts we can very clearly notice that there are.

- 1/- Only five sub topics which have been asked twice during these five years.
- 2/- Only 29 topics have been asked once during these five years.
- 3/- Nearly 29 topics have not been touched at all during these five years.

The section of statics and friction is neglected very badly when compared with dynamics & elasticity. Thus it is clear that the effect of

subjectivity of the paper setter dominates the whole process of "Content Coverage". There is no plan, no principle, no proportion or no thought given to the setting of questions with due weightage to the syllabus.

One traditional view has been definitely maintained and that is to omit that sub topic which has been asked in the previous year. This tendency is a guiding factor for the existing tendency among the students to neglect those topics which have been asked in the previous year and to prepare the topics which were asked in the alternate years.

In the same sheet a separate (in set) Balgraph has been given to facilitate a comparative study of Topics covered and marks allotted to them each year. Thus in 1964 the number of topics covered is 5 and number of marks allotted is 15, same is the case in 1965. In 1966, 67 the number of topics is 8 & 9 respectively but the allotment of marks is 15 only. In 1968, the number of topics is 7 and the number of marks is 17½.

The spread of topics is somewhat regular in 1968. This indicates that the setter is bit conscious about the selection of topics and sub topics.

H E A T

Note :- (Key to the references same as in sheet No. 1)

Following important points can be ~~fr~~ inferred from the graphs in this sheet :-

Total No. of Topics is 8

Total No. of Sub-topics is 50

In 1964, eight topics were asked and 20 marks were allotted to them. A vast blank portion in the horizontal ^{left} ~~dealt~~ of 1964 show that 42 sub-topics were left untouched. Questions with 10 marks were from Gas equations and allied topics. Hygrometry and radiation were given 5 marks each.

In 1965, only four sub-topics were touched and equal weightage of 5 marks each was given to them. The areas touched in the previous year were ignored this year. Thus 46 sub-topics were left untouched. One full question was devoted to one topic only. No question was split into parts dealing with different sub-topics.

In 1966, the first half portion of the syllabus was ignored and 4 sub-topics were from the second half of the syllabus. The total no. of sub-topics touched was 5 and no. of sub-topics left untouched was 45. Only one question was split up to deal with two sub-topics. Each of the remaining three dealt with only one sub-topic. Each question was allotted 5 marks.

In 1967, there was a sudden change. The spread of questions was much better. But the trend of ignoring the topics previously asked was followed. This year the middle $1/3$ portion of the syllabus was ignored. This portion was touched in 1966. The total No. of sub-topics was 10 and each question was split up into small parts each dealing with a separate sub-topic and carrying 1 or 2 marks. Only one question dealt with one single topic and carried 5 marks.

In 1968 There was again shown a better spreading of topics. The number of sub-topics touched was 10 and the spreading of topics was uniform. At least four topics which were touched in 1967 were again asked. This is a clear indication of the effect of "Examination reform movement" as far as the spreading of questions over the content area is concerned. From the inset bar-graphs it is also evident that the years 1967, 68 showed better trend as far as spreading of questions over the content area is concerned.

Study of Sheet No. 3.LIGHT

Note :- (Key to the references same as in sheet No.1.)

Following important points can be inferred from the graphs in this sheet.

1. Total No. of topics as per syllabus is 9.
2. Total No. of sub topics is 54.

In 1964, 9 sub topics were touched, out of which 5 sub topics covered the area of refraction, lenses and prisms. As far as these three topics are concerned the spreading of questions was satisfactory. The remaining 4 sub topics dealt with optical instruments including spectrometer. In this portion, the distribution was also satisfactory. The main defect that can be pointed out is that of concentration of the spreading in the middle $1/3$ of the syllabus. There were no questions on the first 11 sub topics and the last 8 sub topics. The splitting of question and allotment of marks to the parts is also satisfactory. In 1965, there were two questions from this subtopic which were ignored in 1964. Questions carrying $7\frac{1}{2}$ marks were from this portion. Only one question carrying $3\frac{1}{2}$ marks was asked from the portion of Refraction lenses and prisms. In 1964, this area was allotted 10 marks. The questions in spectrometer were split up into three parts and the questions on optical instruments in two parts. The last 7 sub topics dealing with velocity and defects of vision were ignored. Thus on the whole it can be said that the spreading of question was better than that of 1964.

In 1966, again the spreading of questions over the syllabus is defective. Topics previously asked have been ignored. The middle part of the syllabus consisting of nearly 15 sub topics has been ignored. Twenty marks have been allotted to this section and nearly 8 sub topics

In 1967, the spreading of question and the splitting of questions is better than that of 1966. The weightage given to this section is of 22½ marks. Thus the over all choice is great students have to attempt questions with 10 ^{marks} (minimum) or 15 marks (maximum) from this section.

In 1968 ten sub topics have been touched. There are repetitions also. The spreading of questions over the syllabus and the splitting of questions is quite satisfactory. The weightage given to the whole section is that of 22½ marks. The over all choice is again great.

On the whole it can be seen that as far as spreading of questions over the syllabus and splitting of questions is concerned the conditions are improving.

SHEET NO. 4 (Sound)

(All references same as in sheet No. 7)

There are seven topics and thirty sub topics in the portion of " Sound " which forms one part of the second paper .

In 1964 . eight sub topics have been included but the important topics of S.H.M. and Musical Scale have been totally ignored. Questions are well split and the distribution of marks is also satisfactory. The spreading of questions over the syllabus is also satisfactory. Nearly 16½ marks have been allotted to these questions out of which only questions worth 10 marks are to be attempted.

In 1965 . only the first half of the syllabus has been taken into consideration. The other half has been ignored. Only two questions have been repeated. The number of sub topics touched is 6 and the topics of Vibration of strings and air columns and Musical scale have been ignored. Fifteen marks have been allotted to this portion out of which questions worth 10 marks are to be attempted. The spreading of questions over the syllabus is not so uniform as it was in 1964.

In 1966 . there are only three questions. Each question deals with one full sub topic. That means 27 sub topics are totally ignored. The spreading of questions over the syllabus is far from satisfactory. Topics or sub topics previously asked have been ignored. Out of these three question only two (worth 10 marks) are to be attempted.

In 1967 . the first 16 sub-topics have been omitted and questions worth 22½ marks have been asked from the remaining 14 sub-topics. Two questions have been repeated and the spreading of questions over the half of the syllabus is quite satisfactory. The only obvious defect is that the half of the prescribed syllabus has been completely ignored.

In 1968, The spreading of questions over the whole range of syllabus is quite satisfactory and question worth 20 marks have been asked out of which question worth 10 marks are to be attempted. Thus in the year 1964 and 1968 the content coverage can be said to be somewhat satisfactory. The in-set bargraphs clearly show the increasing tendency to allot more marks for the portion of sound. The tendency to include more topics is again obvious in 1967-68.

SHEET NO. 5

Magnetism

There are five topics and twenty nine sub-topics in the portion of magnetism. This portion forms the second part (along-with electricity) of the second paper.

From the graph-sheet it is clear that the first eight sub-topics have never been asked during these five years. The topics of Deflection magnetometer and $\tan A$, & $\tan B$, position appear to be very favourity of the paper setters. Similarly sub-topics from terrestrial magnetism have always been favoured except in 1967.

In 1964, only three sub-topics have been included and 10 marks have been allotted for this portion. The spreading of questions over the syllabus is not satisfactory.

In 1965, Six sub-topics have been included and 12 marks have been allotted for these sub-topics. The spreading of questions over the syllabus is better than that in 1964.

In 1966, the splitting of questions is satisfactory but the whole concentration is in the middle of the syllabus. The first and the last ten sub-topics have been omitted. Five out of the seven sub-topics are from the middle 8 sub-topics of the syllabus. Thus the spreading of questions over the syllabus is not satisfactory.

In 1967, There is only one question split in two sub-topics and carry five marks. The area of Magnetism has been ignored very badly.

Similarly in 1968, the whole concentration is on the last 8 topics. The first 20 topics have been totally ignored. Though the number of sub-topics touched is 8 and splitting of questions is also satisfactory but the spreading of question over the syllabus is not at all satisfactory. There is a growing disinterest in magnetism this is probably due to

the fact that magnetism and electricity are grouped together and from the section B of the second paper. There is no separate identity of magnetism as is the case with general properties, heat, light and sound. Again the total number of sub-topics in electricity is 87 and when combined with the 29 sub-topics of magnetism, the total goes to 116 and it is natural that the paper setter is tempted to ignore the topics of magnetism as he finds topics electro magnetism in the portion of electricity. This inclusion of magnetism with electricity is responsible for lowering down the importance of magnetism.

Sheet No. 4.Electricity

There are 37 sub topics and 17 topics. The portion of electricity along with 29 sub topics of magnetism form the B section of paper second of physics. In general students are required to attempt questions worth 25 marks from this section. Since magnetism and electricity are contained in one section. The students have an option to attempt either all questions from electricity or one or two question from magnetism and remaining four or three from electricity as the case may be.

Now looking to the sheet 4, we find that in 1964, the main concentration is in the middle of the syllabus. The first 50 sub topics are omitted and the last 20 topics have also been omitted. Only 12 sub topics have been touched. There are two full questions each dealing with one sub topics. Rest of the questions are split up in two or three parts. The total marks allotted to electricity are nearly 55%. The spreading of questions over the syllabus is not satisfactory.

In 1965, the condition is still worse. Only 11 sub topics have been touched. Four full question worth 20 marks have been asked and only 1½ question worth 8 marks have been split up in parts. Topics and sub topics touched previously have been omitted and the second half of the syllabus has been practically ignored.

In 1966 the spreading of questions over the syllabus is satisfactory, but the splitting of questions into smaller parts is not satisfactory. There are three questions which have not been split into parts and thus the scope of including more sub topics has not been utilised. ~~Stagnant~~ Any how 15 sub topics have been touched topics & sub topics, have also been repeated. This is a good feature. Nearly forty marks

are allotted to the whole portion of electricity out of which the students have to attempt questions worth 25 marks. The overall choice is very great which may not be regarded as a merit of the question paper.

In 1967, the spreading of questions over the syllabus is again defective. Ten sub topics from the first forty subtopics have been included and the weightage given to this part is nearly of 21½ marks. Only six subtopics have been included from the remaining 47 sub topics has been repeated. The tendency to avoid. The topics previously touched is also present. Nearly 20 subtopics from the middle part of syllabus have been ignored.

In 1968, the splitting of questions is more effective. there are only two full questions dealing with only one sub topic. Rest of the questions are split into parts and each part deal with different sub topics. In all 12 subtopics are included. The spreading of questions over the first half of the syllabus is uniform but over the remaining half it is defective. The weightage given to the first half is of 20 marks and that to the second half is of 10 marks only. Students have less overall choice this year as they have to attempt questions with 25 marks out of 30 marks allotted for this portions.

On the whole it can be said that there is a definite improvement in the spreading of questions over the syllabus and splitting of question into smaller parts.

A comparative study of the content area prescribed in the syllabus weightage of marks given to the area during these five years and range of marks with in which the examinee had to work in each area during these year can be easily done with the help of the bargraphs on sheet No-7.

References : (1) One small square on the vertical scale of the graph represents " One Unit " and is used to denote "One sub-topic" for the column denoting topics and sub-topics and "One mark " for the column denoting marks.

(2) In each of the sections-general properties of matter Heat, Light, Sound, magnetism and electricity three bars have been drawn.

The first bar represents the total No. of sub topics and topics the section as prescribed the syllabus. Each thick bar the column represents one topic and its length indicates the no. of sub topics included in it. For the sake of convenience. The topics have been numbered on the left hand side from below of the main column, and the no. of sub-topics included in the main topic is written in side the column.

For example in the section of general properties the first column (Bar) indicates that there are 8 main topics and 63 sub-topics. The second bar stands for the total marks allotted by the paper setter to the questions in this particular section i.e. general properties. A careful glance at the bar will show that the range has varied from 15 to $17\frac{1}{2}$ during these five years.

The third column stands for the range of marks with in which the examinee can attempt questions from this section. Here again the range varies from 5 to 10.

Thus an area of content having 63 sub-topics has a minimum allotment of 5 marks and maximum of 10 marks. Similarly, all other sections have been represented in the graph.

The first three sections G., Heat & Light constitute the first paper and the last three sections Sound, Magnetism & Electricity constitute the second paper.

Thus this graph represents both papers alongwith the sections included in them.

Inferences that can be drawn from the graphs.

- 1/- Allotment of marks is not proportionate to the content area.
- 2/- General properties of matter has been badly ignored.
- 3/- Light has been given much importance in the first paper.
- 4/- There has always been a choice for the candidate to attempt more or less questions with 5 marks from any of the three sections in first paper.
- 5/- In the second paper area of contents in magnetism can be safely ignored as " Magnetism & Electricity " are included in an section and sound in other. From the graph we can see that a candidate attempting 10 marks from sound can safely omit magnetism and attempt 25 marks from electricity.
- 6/- Allotment of marks for the portion of electricity has a very wide range. 28 - 49. This indicates the subjectivity of the paper setter. Setter interested in Electricity has allotted 49 marks to that portion and only 10 marks for magnetism. Thus there is a great chance for speculation and looking the trends the students are apt to be tempted to ignore magnetism. At the same time 10 marks in sound are compulsory and the allotment of marks to this portion has varied between 15-22 . Thus after attempting compulsory 10 marks from sound or candidate is left with 4 possible combinations :-

1/-	Magnetism	0	Marks	Electricity	25	Marks.
2/-	"	5	"	"	20	"
3 -	"	10	"	"	15	"
4/-	"	15	"	"	10	"

The achievement of candidates attempting such different combinations can not be treated as a sound basis for testing the reliability of the test.

7/- Thus we find that the weightage of marks is roughly in inverse proportion of the content area. In fact it ought to have been in direct proportion.

CHAPTER IV.

CONCLUSIONS AND SUGGESTIONS.

CONCLUSIONS.

From the analysis of the question papers in physics the following important conclusions can be drawn.

1. No attention has been paid to give proportional weightage to test the objectives for which physics is being taught at this level.

2. Accumulation of knowledge and reproducing the crammed facts from memory has been given much importance.

3. The objectives of skill and application have been badly ignored. Intelligent problems needing the skill of applying knowledge to new situations have rarely been raised.

4. Numerical questions are also not of good standard. They are more of mechanical nature and less for intelligent application of principle learned.

5. The weightage of marks is not mentioned clearly anywhere. Only five marks have been allotted to one question. No mention has been made regarding the allotment of marks to the different parts of a question. Simple and difficult questions all have been given equal weightages of 5 marks. No indication of any consideration of time required to answer a question and the marks that it carries for that is there.

6. The questions are not in the order of increasing or decreasing order of difficulty. There appears no psychological principles in the order of question in the paper. The only logic is to follow the order given in the syllabus.

7. The selection of topics clearly points to the subjectivity of the paper setter. Questions from the area of interest of paper setter appear to be better when compared with these questions from the area in which the paper setter appears to have less interests.

8. The spreading of question over the syllabus clearly indicates that the paper setters are not in favour of repeating the topics previously asked and hence to the rule 'follow alternate years'. has been established.

9. Instructions regarding the 'limit and scope' of a questions are not there. The candidate is free to write as much as he knows.

10. The over all choice is very great and this the test tends to be more unreliable. The importance of general properties of matter and magnetism is minimised due to the trend of allowing greater over all choice.

11. Questions are not well split. Devoting one full question to only one sub topic has also, lowered down the quality of the question paper.

12. The whole trend of question papers helps to strengthen the prevailing belief in 'Chance' 'Fate' and 'Guess'.

13. The content coverage is far from satisfactory. There ^{are examples} ~~are examples~~ where through out these five year many topics and sub topics have been touched even once.

14. Practically all question asked up till now are essay type or long answer type question. No short answer question or fixed answer type questions have been asked.

In short we can say that the trend followed during 1964-65 is far different from the trend that we preach today.

SUGGESTIONS:

Having arrived at the above conclusion, it would not be out of place if we discuss in short the various suggestions which may prove helpful in removing most of the short comings of the question papers.

1. Regarding objectives.

The measures that could be suggested are :-

(a) Instructional objectives of the subject in question should be ^{selected} ~~so-selected~~

(b) Proportionate ^{of} weightage should be given to each of the instructional objectives for framing questions.

(c) Different form of questions should be used for testing the objectives.

The aforesaid measures will help to achieve validity of the question paper.

2. Regarding subjectivity of the paper setter.

The steps that could help overcome the factor of subjectivity could be stated as follows .

(a) Developing of a design of the question paper by the examining agency and passing it on to the setter. This design should ~~be~~ give specific directions regarding the dimensions of the question paper and the considerations to be kept in mind while setting it. The design would include the following details :-

- (i) Weightage to objectives.
- (ii) Weightage to area of content.
- (iii) Weightage to different form of questions.
- (iv) Scheme of options (complete designation of over all options and allowing option only in essay questions, subject to condition that they are comparable in respect of objective content area, form, difficulty level, expected time for answering it etc.)

- (v) Directions regarding administration of the question paper.
- (b) Introduction of question which can be assessed objectively viz the short answer and objective type (multiple choice questions).
- (c) Wording questions specifically so as to delimit the scope and length of the expected answer.
- (d) Preparations of a scoring key and a marking scheme by the setter alongside with the setting of the question paper itself.

This will ensure objectivity in setting the question papers, in writing answers and in scoring answer scripts.

5. Content coverage.

The steps that could be taken to ensure an effective coverage of content through questions paper could be :-

- (a) Selection of the major areas of content and giving proportion etc weightage to them for framing questions.
- (b) Constructing questions equivalent to the value of the respective weightage to different areas of content.
- (c) Introduction of short answer and objective type questions in an increasing measure.
- (d) Restricting options, retaining them only in the essay type questions and there too after ensuring their comparability.

The aforesaid steps would get to ensure higher reliability of the question paper.

3.

Content coverage.

The steps necessary to be taken in this regard are as follows:-

(a) The division of the question paper into two parts.

Part A consisting of fixed response question and Part B consisting of free response questions.

(b) Both the sections should be administered simultaneously.

The first one will need to be collected earlier after the expiry of a specified time limit say half an hour or so. This step would not allow students to get an opportunity of copying which is very easy in respect of fixed response question.

(c) Giving precise directions to the setters for setting and the examiners for scoring the question papers.

The measure suggested above make the test practicable.

S Y L L A B U S

First Paper - Properties of Matter, Heat and Light.

General Properties of Matter.

Fundamental Units of F.P.S. and C.G.S. systems and their measurements. Trigonometrical ratios. Principles of Vernier scale, Screw gauge and Spherometer.

S T A T I C S

Scalar and Vector quantities. Principle of parallelogram of forces and its verification. Resolution of forces. Introduction of the principle of triangle of forces. Equilibrium of bodies. Simple Machines. Levers. Couples.

Principle of a balance with use of rider, expression for sensitiveness, other requisites of a good balance and weighing with a faulty balance.

F R I C T I O N

Laws, Coefficient of friction- Advantages and Disadvantages.

D Y N A M I C S

Velocity, Acceleration. Equations of motion. Motion freely under gravity. Newton's laws of motion, Mass and Weight. Units of work and energy. Potential and Kinetic energies of bodies. Moment of Inertia of a body.

Newton's Law of gravitation. Acceleration due to gravity.

S.H.M., characteristics, examples, derivation of the periodic time with a special reference to simple pendulum.

E L A S T I C I T Y

Hooke's Law. Young's Modulus, Searle's method for the determination of Young's Modulus.

Introduction of surface tension.

Pressure in liquids, Pascal's Law. Hydraulic press. Suction or

lift and Force pumps.

Atmospheric pressure and its measurement by Aneroid and Fortin's barometers. Boyle's Law. Compression, Filter, and Teepler's pump. Suction-gauge

Archimedes' principle and its application in the determination of the specific gravities of liquids and solids.

Variable immersion type and Nicholson's. Use of Nicholson's hydrometer in determining the specific gravity of solids and liquids.

The Siphon and its applications.

HEAT

Heat and temperature. Effect of Heat on bodies. Thermometric substances and their properties. Mercury as one of them. Advantages and disadvantages of mercury thermometers. Alcohol thermometers. Expansion of solids, liquids and gases. Experimental determination of coefficient of expansion. Real and apparent coefficient of expansion of liquids and their determination. Temperature correction of barometers. The constant volume and constant pressure gas thermometers. Gas equation. Specific and Universal gas constants. Units of Heat. Sp.Heat of solids and liquids and their determination by Regnault's apparatus. Newton's Law of cooling and its application. Sp.Heat of a gas by Regnault's apparatus. Latent heat. Laws of fusion and those of boiling and evaporation with special reference to ice, water and steam. Its determination by Bunsen's ice calorimeter. Sp. of a gas by Joule's Steam Calorimeter. Vapour pressure of liquids with special reference to water vapour. liquifaction of gases. Critical pressures and critical temperature of gases.

HYGROMETRY

Absolute humidity and Relative humidity. Their measurement by Daniell's Regnault's, Mason's (wet and dry bulb) hygrometers. The first law of thermodynamics. Mechanical equivalent of Heat and its determination by Searle's apparatus, Elements of steam engine.

Modes of transference of heat. Coefficient of thermal conductivity. Variable and steady states. Searle's method for determination of conductivity. Convection and its applications.

Radiation. Detectors of thermal radiations- Crookes's Radiometer. Leslie differential air thermometer. Thermopile. Properties and laws of heat radiations. Inverse square law and its verification. Emissive and absorptive powers and their comparison Stephen's Law, Newton's Law of cooling and its verification.

L I G H T

Photometry Inverse square law, Standard candle power. Bunsen's grease-spot photometer. Reflection of light from plane surface. Theory of lamp and scale arrangement for the measurement of small deflections. Hadley's sextant. Reflections from convex and concave curved spherical surfaces. Refraction at plane, spherical (concave and convex) surfaces. Critical angle and total reflection. Passage of a ray through several media having surfaces of separation parallel. Total internal reflection method for the determination of refractive index of a liquid. Concave and convex lens complete. Different methods for the focal lengths of mirrors and lenses. Refraction through prism.

Simple and compound microscopes. Expressions for their magnifying powers. Astronomical, Terrestrial, Galilean telescopes and their magnifying powers, Spectrometer and its uses. Different types of prismatic spectra and methods of producing them. Determination of velocity of light, Foucault's and Fizeau's methods.

Eye and defects of vision.

SYLLABUS

Second Paper:- Sound, Electricity and Magnetism.

SOUND

Production and propagation of sound. Velocity. Newton's Law and Laplace's correction. Effect of pressure, temperature and humidity on the velocity. Characteristics of a note. Quality, pitch (frequency), intensity or loudness. Waves and their characteristics. Transverse, Longitudinal and Stationary waves. Combination of two S.H.M.'s along one straight line or at right angles, with or without phase difference having same or different periods and amplitudes (Lissajous figures). Methods of determining the frequency of a fork and sonometer.

Vibrations of strings (sonometer) and their laws. Harmonics. Vibrations of air columns in tubes open at one or both ends. Interference of sound waves. Kundt's tube. The musical scales. Gramophone.

ELECTRICITY

Inverse square law and its verification. Electric field and lines of force. Electrical potential and its measurements. Capacity of a conductor, that of a sphere. Principles of a condenser. Spherical and parallel plate condensers. Specific inductive capacity. Condensers in series and parallel. Wimshurst induction machine. Causes of atmospheric electricity. Lightning and lightning conductors. Electric current. Primary cells with actions which take place within them. Means of reducing polarization and local action with special reference to Daniell, Bichromate, Leclanche cells.

Magnetic effects to electric currents. Ampere's and Maxwell's rules. Laplace's law. Units of measuring current strength. Principle working of a tangent galvanometer. Expression for its reduction factor. Galvanometer constant and its sensitiveness.

Ohm's law. Ohm's law applied to complete circuit. Internal resistance of a cell. Grouping of cells in series, parallel and mixed. Resistance coils and their winding. Experiments with tangent gal-vanometer. Comparison of E.M.F.'s and determination of reduction factor. Theory of Wheatstone bridge with special reference to meter bridge and P.O. box.

Fleming's left-hand rule. Principle and working of a moving coil galvanometer. Weston movement voltmeter. Ammeter. Internal resistance of a cell using voltmeter ammeter. Principle of potentiometers and its use in comparing E.M.F.'s. Conduction of electric current through solutions. Examples of electrolysis. Faraday's laws of electrolysis. Copper and silver voltmeters and their uses. Theory of simple cells. Acid accumulators.

Joule's law. Joule's calorimeter. Electric power. Electric furnaces. Arc lamps, electric bulbs. House-lighting circuit. Thermoelectricity. Cu-Fe thermo couples.

Faraday's discovery of Electro-magnetic induction. Lenz's Law. Magnitude of E.M.F. produced by induction coil in details. Definitions of coefficients of self and mutual induction. Effects of self-induction in bridges. Eddy currents and their applications.

Alternating currents. A.C. dynamos. Conversion of A.C. to D.C.

D.C. Dynamos-Electric meters.

Applications of electricity-Telegraph, Bell telephone, Carbon microphones Loudspeakers.

THE NEW PHYSICS

Discharge of Electricity through gases. Production and properties of cathode rays and X-rays. β -Radiations and their properties. Radium and radio-activity.

Elementary treatment of the diode and triode valves.

MAGNETISM

Magnets and magnetic materials. Permanent and temporary magnets.

Magnetic field. Pole strength. Lines of force. Drawing of lines of force and calculation of pole strength from the position of the neutral points with respect to the position of the magnet. Uniform magnetic field.

Couple acting on a magnet suspended in a uniform field. Magnetic moment.

Field of a magnet along the end on and broad side on positions of a magnet.

Tangent law. Use of deflection magnetometer in determining M_1M_2 , in Tan

A and Tan B position's of Gauss. The ratio by null method Comparison of field strengths. Verification of Inverse square law.

Vibration of a freely suspended magnet. Its periodic time.

Vibration magnetometer and its uses in comparing the magnetic moments.

Field strength at two places and verification of Inverse square law.

TERRESTRIAL MAGNETISM

Declination. Isogonic and agonic lines. Elements of Earth's

field. Angle of dip and total intensity. Experimental determination of the

horizontal components of the Earth's field. Angle of dip.

SELECTED BIBLIOGRAPHY

1. Anastasi, Anne: Psychological Testing, New York: Macmillan, 1961. 657 p. 7.50
2. Cronbach L.J. : Essentials of Psychological Testing, New York: Harper & Bros, 1949. 475 p. 4.50
3. Garrett, Henry E., Statistics in Psychology and Education, (Fifth Edition) New York, Longmans, Green & Company, 1958 471 p. 5.50
4. Guilford, J.P. Fundamental Statistics in Psychology and Education, (Third Edition) New York: McGraw-Hill Book Co. Inc. 1956. 584 p. 6.75
5. Jordan, A.M. Measurement in Education--An Introduction. New York: McGraw-Hill Book Company, Inc. 1953. 533p. 6.75.
6. Travers, Robert M.W. How to make Achievement Tests. New York: The Odyssey Press, 1950. 130 p. 2.50
7. Travers, Robert M.W. Educational Measurement. New York: The Macmillan Co. 1955. xix+420 p. 4.75.
8. Travers: An Introduction to Education Research (Revised Edition) New York, Macmillan.
9. Report of The Education Commission 1964-1966